ALASKA

VOLUME XIII

HARRIMAN ALASKA EXPEDITION
WITH COOPERATION OF WASHINGTON ACADEMY OF SCIENCES

ALASKA

VOLUME XIII

LAND AND FRESH WATER MOLLUSKS

BY WILLIAM H. DALL

HYDROIDS

BY C. C. NUTTING

H·A·E

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PREFACE

THE present volume comprises two papers: one on the Land and Fresh Water Mollusks of Alaska, by Dr. Wm. H. Dall; the other on the Hydroids of the Expedition, by Prof. C. C. Nutting. Dr. Dall's paper has not been previously published; Professor Nutting's appeared in the Proceedings of the Washington Academy of Sciences in May, 1901. The number of new Mollusks here described is twelve; of new Hydroids twenty.

C. HART MERRIAM,
Editor.

WASHINGTON, D. C.,
June 15, 1905.

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LAND AND FRESH WATER MOLLUSKS OF ALASKA AND ADJOINING REGIONS

NOTE

The following memoir has been prepared to bring together and modernize the data existing in the literature, and to combine it with the new material obtained by the Harriman Expedition and such as was accessible elsewhere from the same region. In order to accomplish this, and because of the uniformity of boreal faunas all round the northern hemisphere, it has been necessary to examine the entire boreal fauna of North America, Greenland, and the adjacent parts of eastern Siberia.

The material examined has been that collected by the Harriman Expedition; that obtained by the writer during explorations in Alaska from 1865 to 1885, and now in the National Museum; collections from various collaborators of the Museum, members of the Navy, the Revenue Marine, and the Geological Survey of the United States; and certain material borrowed for examination from various sources. On the whole, though the collection is not remarkably large, it is probably the largest and most complete, for the region, ever brought together.

The text figures have been generously lent by the Smithsonian Institution.

I am indebted to Mr. Bryant Walker, Dr. J. F. Whiteaves of the Dominion Geological Survey, Dr. H. A. Pilsbry, of the Academy of Natural Sciences, Philadelphia, and numerous other correspondents, for advice and assistance; and to the authorities of the U. S. Geological Survey, the Dominion Geological Survey, the Smithsonian Institution, and the U. S. National Museum, for facilities for study and access to collections, for all of which I am deeply grateful.

Wm. H. Dall.

Smithsonian Institution,
Washington, D. C., Sept. 17, 1904.

LAND AND FRESH WATER MOLLUSKS OF ALASKA AND ADJOINING REGIONS

BY WILLIAM HEALEY DALL

GENERAL DISCUSSION AND RESULTS

THE first object of this work is to sum up the known molluscan fauna of the land and fresh waters of Alaska. This has involved an examination, not only of the species obtained within the political boundaries of Alaska, but also those of the adjacent region to the west, east, and south. The result is that, for North America north of latitude 49° North, the work includes a summary of our present knowledge of the mollusks, deduced in part from the literature and in larger part from material actually examined. To this is added a briefer examination of the mollusk fauna of the adjacent parts of eastern Siberia which has to some extent modified that of Alaska. As a whole the work may be regarded as forming a synoptic manual of the boreal land and fresh water mollusks of the western hemisphere.

I. SUMMARY OF THE DISTRIBUTION OF FRESH WATER SPECIES IN ALASKA AND ADJACENT REGIONS.

It was thought best to tabulate the species of rivers and lakes according to the drainage systems in which they are found. Of course these systems are not geologically ancient, and it is even probable that some existing species of the Mississippi system were trapped by the changes of level which, according to Gen. G. K. Warren, U.S.A., secured, for the Red River of

the North, part of the channels which earlier discharged into the Gulf of Mexico by way of the Mississippi. It is probable, for the region under review, that the entire molluscan population was exterminated or driven south during the Glacial epoch, and that we now have to do with immigrants from the south whose distribution has taken place since that time.

In the following tables all doubtful species are omitted, so that the fauna tabulated, if not complete, is at least well established so far as it goes.

The following areas are represented in the successive columns of the table:

Asia. — This column indicates those species known also to inhabit the eastern portion of Siberia, Kamchatka, and the Chukchi Peninsula, together with the Commander Islands, which are obviously populated from the Asiatic shores.

Yukon. — This system includes the entire drainage basin of the Yukon and the tundra north of it, as well as the area drained by the Kuskokwim River, or all of Alaska north, northwest, and westward of the Alaskan Range, as well as the area behind the Coast Ranges and between them and the northward extension of the Rocky Mountains, drained by the Yukon and its tributaries.

Alaska. — This system includes all of the Aleutian Islands, the area on the Alaska Peninsula and continent between the Coast Ranges and the Alaskan Range and the Pacific north of latitude 54°. This system and the following one are really continuous, the Alaskan being really only the northwestward extension of that here designated as the Pacific system.

Pacific. — This includes the coast drainage of British Columbia, the basins of the Fraser and Columbia rivers, the coastal part of the State of Washington, and the northern part of Idaho and Montana west of the Selkirk Range and its more southern equivalents in the Rocky Mountain region.

Mackenzie. — This vast system includes the basin drained by the Mackenzie River and its tributaries, covering northwest Alberta, northeastern British Columbia, the northwestern two thirds of Athabaska, and the Mackenzie district.

Hudson Bay. — This system, the largest of all, comprises the entire area draining into Hudson Bay, including Keewatin, the southeastern corner of the Mackenzie district, eastern Athabaska, the whole of Saskatchewan, the southeastern two thirds of Alberta, Assiniboia and Manitoba, the drainage area of the Red River of the North in the Dakotas and northeastern Minnesota, all of Ontario, Quebec, and Ungava north and west of the 'Height of Land.'

Canada. — This system comprises the drainage of the St. Lawrence and the Great Lakes south and east from the Height of Land, including the island of Anticosti.

Labrador. — This comprises the area draining into Ungava Bay and the Atlantic north of the Straits of Belle Isle and the Height of Land, being the Labrador coast and the northeastern part of the Ungava district of the Dominion of Canada.

A few species are noted from Greenland; when peculiar to Greenland, or found in Greenland and also on the continent, the species have been entered in the Labrador column but distinguished by an asterisk.

The vast territories included in these drainage systems are, it is true, only partially and imperfectly explored for mollusks. Yet certain portions of them are tolerably well known, and the uniformity imposed on the fauna by its high northern position and unvaried conditions leads to the belief that while much is yet to be known in tracing out the details of distribution, little is to be expected in the way of absolutely new species, even from this immense territory still to be explored. It would be rash to conclude that nothing new remains to be found; but it certainly behooves us to be moderate in our expectations.

It is probable that new additions will be made from among the ranks of the smaller species, such as *Corneocyclas* (or *Pisidium*), *Vertigo*, and the more minute *Helicidæ*. Perhaps a considerable number of the more southern forms which are known to approach the boundary will eventually be found to pass beyond it; and other additions to the list will result from the more careful discrimination of similar or closely allied species.

TABLE I. DISTRIBUTION OF FRESH WATER SHELLS NORTH OF LATITUDE 49°, ACCORDING TO THE DRAINAGE SYSTEMS NOW EXISTING.

Name of Species.	Asia.	Yukon.	Alaska.	Pacific.	Mackenzie.	Hudson Bay.	Canada.	Labrador.
Lymnæa stagnalis	o	o	o	o	o	o	o	
Lymnæa petersi		o	o					
Lymnæa atkensis			o					
Lymnæa megasoma						o	o	
Lymnæa emarginata		o				o	o	
Lymnæa binneyi				o		o	o	
Lymnæa preblei						o		
Lymnæa columella						o	o	
Lymnæa randolphi		o		o				
Lymnæa kirtlandiana							o	
Lymnæa truncatula	o		o		o	o		
Lymnæa humilis						o	o	
Lymnæa desidiosa				o		o	o	
Lymnæa galbana			o	o		o	o	
Lymnæa hölbölli							o	*
Lymnæa vahli		o	o	o	o	o	o	o*
Lymnæa palustris	o	o	o	o	o	o	o	o
Lymnæa reflexa						o	o	
Lymnæa catascopium				o	o	o	o	o
Lymnæa adelinæ				o				
Lymnæa? perpolita		o						
Lymnæa caperata						o		
Lymnæa anticostiana							o	
Planorbis bicarinatus				o		o	o	
Planorbis corpulentus						o	o	
Planorbis binneyi				o				
Planorbis trivolvis		o	o	o	o	o	o	
Planorbis campanulatus					o	o	o	
Planorbis var. rudentis						o		
Planorbis exacuous		o				o	o	
Planorbis var. megas						o		
Planorbis opercularis				o				
Planorbis var. planulatus		o		o				
Planorbis hirsutus		o			o	o	o	
Planorbis var. deflectus		o	o		o	o	o	
Planorbis parvus		o			o	o	o	
Planorbis vermicularis				o				o*
Planorbis nathorsti								o*
Planorbis arcticus								o*
Planorbis umbilicatellus						o		
Planorbis crista						o	o	
Segmentina armigera					o	o	o	
Segmentina christyi					o	o		
Physa heterostropha					o	o	o	
Physa gyrina		o			o	o	o	
Physa ancillaria						o	o	
Physa lordi				o		?	?	
Physa propinqua				o				

TABLE I. DISTRIBUTION OF FRESH WATER SHELLS NORTH OF LATITUDE 49°, ACCORDING TO THE DRAINAGE SYSTEMS NOW EXISTING.—*Continued.*

Name of Species.	Asia.	Yukon.	Alaska.	Pacific.	Mackenzie.	Hudson Bay.	Canada.	Labrador.
Physa ampullacea		o		o				
Physa hordacea				o				
Aplexa hypnorum		o		o	o	o	o	
Ancylus rivularis						o	o	
Ancylus parallelus						o	o	
Ancylus fragilis				o				
Ancylus kootaniensis				o				
Goniobasis plicifera				o				
Amnicola limosa						o	o	
Amnicola pallida						o	o	
Amnicola emarginata						o	o	
Amnicola cincinnatiensis						o	o	
Lyogyrus granum						o	o	
Pomatiopsis lapidaria						o	o	
Fluminicola nuttalliana				o				
Fluminicola virens				o				
Valvata tricarinata					o	o	o	
Valvata sincera						o		
Valvata lewisi				o	o	o	o	
Valvata var. helicoidea		o		o			o	
Valvata mergella		o	o					
Valvata virens				o				
Campeloma decisum						o	o	
Lampsilis ventricosus						o	o	
Lampsilis luteolus					o	o	o	
Lampsilis borealis						o	o	
Lampsilis radiatus						o	o	
Lampsilis ligamentinus						o	o	
Lampsilis rectus						o	o	
Lampsilis ellipsiformis						o	o	
Lampsilis alatus						o	o	
Lampsilis gracilis						o	o	
Strophitus rugosus						o	o	
Anodonta beringiana	o	o	o					
Anodonta oregonensis			o	o				
Anodonta nuttalliana				o				
Anodonta wahlamatensis				o				
Anodonta marginata						o	o	
Anodonta implicata						o	o	
Anodonta grandis						o	o	
Anodonta kennicotti					o	o	o	
Anodonta pepiniana						o	o	
Anodonta kennerleyi				o				
Gonidea angulata				o				
Anodontoides ferussacianus						o	o	
Symphynota costata						o	o	
Symphynota complanata					o	o	o	
Margaritana margaritifera	o					o	o	

TABLE I. DISTRIBUTION OF FRESH WATER SHELLS NORTH OF LATITUDE 49°, ACCORDING TO THE DRAINAGE SYSTEMS NOW EXISTING.—*Continued.*

Name of Species.	Asia.	Yukon.	Alaska.	Pacific.	Mackenzie.	Hudson Bay.	Canada.	Labrador.
Margaritana var. falcata			o	o				
Unio complanatus						o	o	
Quadrula plicata						o		
Quadrula undulata						o	o	
Quadrula heros						o		
Quadrula lachrymosa						o	o	
Quadrula rubiginosa						o	o	
Sphærium simile						o	o	
Sphærium striatinum				o	o	o	o	
Sphærium solidulum						o	o	
Sphærium stramineum						o	o	
Sphærium rhomboideum		o		o		o	o	
Sphærium walkeri					o			
Sphærium fabale						o	o	
Sphærium occidentale				o		o	o	
Sphærium patella				o				
Sphærium emarginatum						o	o	
Sphærium tumidum				o				
Sphærium spokani				o				
Sphærium raymondi				o				
Sphærium partumeium						o	o	
Sphærium jayanum						o	o	
Sphærium tenue		o			o	o	o	
Sphærium transversum						o	o	
Sphærium truncatum						o	o	
Sphærium lenticulum				o				
Corneocyclas virginica		o				o	o	
Corneocyclas idahoënsis		o						
Corneocyclas scutellata					o			
Corneocyclas æquilateralis	o	o					o	
Corneocyclas compressa		o		o			o	
Corneocyclas variabilis		o				o	o	
Corneocyclas abdita	o	o	o			o	o	
Corneocyclas ventricosa					o	o	o	
Corneocyclas rotundata		o				o		
Corneocyclas steenbuchi								o*
Corneocyclas occidentalis				o				
Corneocyclas ultramontana				o				
Corneocyclas arctica		o						
Corneocyclas nivalis		o						
Corneocyclas glacialis		o						
Corneocyclas pulchella						o		
Corneocyclas henslowana						o	o	

II. SUMMARY OF THE DISTRIBUTION OF THE LAND SHELLS OF ALASKA AND ADJACENT REGIONS.

I have summarized the distribution of the fresh water shells by drainage areas, as perhaps the least objectionable method of connecting the facts of distribution. But the land shells require a somewhat different treatment, since their distribution has nothing to do with currents of water, though sometimes a snail may be carried in the spring freshets under the bark of a floating log, and by rare chance survive to be stranded by the falling waters somewhere down stream. A certain amount of movement of the minute forms may result from the distribution by high winds of dead leaves and other light material to which the smaller land shells are accustomed to adhere. Pieces of ice from smaller brooks carried by freshets may also convey a certain distance and deposit, when stranded by falling water, pieces of bark or leaves containing snails or their eggs. Such chances are too rare to be made much account of, and doubtless the distribution of our smaller snails is brought about in the main by the slow movement of individuals.

The Pulmonate fauna of Alaska is composed of four elements: contributions from the faunas of Asia, of the Pacific Coast of America, of the Canadian (or Hudsonian) region, and of the circumboreal or common subarctic fauna of the whole northern hemisphere.

In tabulating the distribution of the species a column may be reserved for each of these elements; the circumboreal column being headed 'Europe.' A column may be reserved for Greenland, and another for the approximate highest north latitude which the species is known to attain. This means for the snail not so much differences of temperature corresponding to latitude, as differences of period in activity, which diminish as one proceeds northward. Snails at Point Barrow must remain in a state of hibernation at least nine months in the year, and I suspect that this more probably brings a limiting strain on the vitality of the organism than would the mere occurrence at times of a specially low temperature.

TABLE II. DISTRIBUTION OF AMERICAN LAND SHELLS NORTH OF LATITUDE 49°.

Name of Species.	Asia.	Alaska.	Pacific.	Canadian.	Greenland.	Europe.	N. Lat.
Helix hortensis				o		o	54°00′
Epiphragmophora fidelis		o	o			o	57 00
Zoögenites harpa	o	o		o		o	66 00
Vallonia pulchella	o		o	o		o	54 00
Vallonia costata	o			o		o	51 00
Vallonia gracilicosta				o			52 20
Vallonia albula			o	o			50 00
Vallonia asiatica	o	o				o	59 00
Polygyra devia			o				50 00
Polygyra columbiana		o	o				60 00
Polygyra townsendiana			o				50 00
Polygyra germana			o				49 00
Polygyra monodon				o			51 20
Polygyra albolabris				o			53 00
Strobilops labyrinthica				o			51 20
Bifidaria armifera				o			52 10
Bifidaria contracta				o			50 00
Bifidaria holzingeri				o			52 10
Bifidaria pentodon				o			51 20
Pupilla blandi				o			52 10
Pupilla muscorum		o		o		o	59 00
Vertigo hoppii				o	o		70 00
Vertigo modesta	o	o	o	o			63 00
Vertigo columbiana		o	o				57 00
Vertigo gouldii				o			51 00
Vertigo ventricosa				o			51 25
Vertigo binneyana			o	o			50 00
Vertigo ovata	o	o	o	o			57 35
Vertigo arctica	o	o				o	65 15
Cochlicopa lubrica	o	o	o	o		o	71 20
Circinaria vancouverensis		o	o				59 00
Circinaria var. chocolata		o					57 00
Circinaria sportella		o	o				59 00
Circinaria var. hybrida		o	o				55 00
Vitrina angelicæ					o		72 00
Vitrina limpida				o			54 00
Vitrina alaskana		o	o				57 30
Vitrea radiatula	o	o	o	o		o	71 20
Vitrea nitidula				o		o	61 00
Vitrea binneyana			o	o			50 00
Vitrea indentata				o			50 00
Euconulus trochiformis	o	o	o	o	o	o	70 00
Zonitoides nitidus	o	o	o	o		o	61 00
Zonitoides arboreus	o	o	o	o			61 00
Zonitoides randolphi				o			59 30
Zonitoides minusculus		o	o	o			59 00
Zonitoides milium				o			50 00
Zonitoides pugetensis			o				49 00
Pristiloma lansingi			o				49 00
Pristiloma stearnsii		o	o				59 30

TABLE II. DISTRIBUTION OF AMERICAN LAND SHELLS NORTH OF LATITUDE 49°.—*Continued.*

Name of Species.	Asia.	Alaska.	Pacific.	Canadian.	Greenland.	Europe.	N. Lat.
Pristiloma taylori			o				49°00′
Pristiloma ? arctica		o					71 25
Agriolimax agrestis	o		o	o	(?)	o	61 00
Agriolimax hyperboreus	o	o	o	o		o	65 00
Agriolimax berendti			o				49 00
Prophysaon andersoni			o				49 00
Prophysaon var. pallidum		o	o				54 45
Prophysaon var. pacificum			o				49 00
Prophysaon humile		o	o				55 38
Ariolimax columbianus		o	o				58 00
Pyramidula solitaria			o	o			52 00
Pyramidula striatella				o			61 00
Pyramidula cronkhitei		o	o				61 00
Pyramidula asteriscus			(?)	o			49 00
Oreohelix strigosa				o			49 30
Oreohelix var. cooperi				o			49 00
Helicodiscus lineatus			o	o			50 00
Punctum pygmæum			o	o			50 00
Punctum clappi			o				49 00
Punctum conspectum	o	o	o				60 00
Sphyradium edentulum	o	o	o	o		o	65 20
Succinea oregonensis			o				49 00
Succinea retusa		o	o	o			67 00
Succinea hawkinsi			o	o			57 00
Succinea avara				o			62 00
Succinea grönlandica					o		65 00
Succinea grosvenori				o			62 00
Succinea var. alaskana		o	o				63 30
Succinea rusticana			o				49 00
Succinea nuttalliana			o				49 00
Succinea obliqua				o			61 00
Succinea chrysis	o	o			o		65 30
Siphonaria thersites		o	o				60 30
Onchidium boreale		o	o				60 30
Carychium exiguum			o	o			50 00
Carychium exile				o			50 00

III. SUMMARY OF THE MOLLUSK FAUNA OF NORTHEASTERN ASIA.

The land shell fauna of the northeast extremity of Asia has little individuality, but represents a mingling of the depauperated extremes of the faunas of northeast China, and of Europe, with that series of species which is sometimes called the circumpolar or circumboreal fauna.

Much of the apparent poverty of the fauna may be due to insufficient collecting, but even when the most generous allowance for this factor is made, it still remains certain that the molluscan population is far less in variety than might reasonably be expected.

The Palearctic fauna of Europe appears to extend clear across northern Asia, losing a large proportion of its species on the way, until (if the circumboreal species be excluded) only about thirty species reach the headwaters of the Lena and the barrier of the Stanovoi Range. A very remarkable local fauna exists in the great 'relicten-see' of Siberia, Lake Baikal, but it does not appear to have tinctured the east Siberian fresh water fauna outside of that lake, to any appreciable extent. It is possible that the comparatively recent emergence of a large part of eastern Siberia from the sea, and the presence of the vast desert region to the south and west, may enter into the explanation of this sparse shell fauna, as well as of some of the peculiarities of the Baikal faunula.

Southeast of the Stanovoi Range we find between the mountains and the sea, the valley of the Amur and several smaller valleys, such as the drainage basins of the Ud and the Tugar. To the southwest the sources of the Amur emerge from the deserts of Gobi and Dauria, and along the line of these water courses has crept a certain number of molluscan forms intimately related to or identical with those of Mongolia, China, and the Orient. This forms the second element of the fauna of northeast Siberia. The number of purely endemic species is remarkably small, and a portion of those claimed to be of this character are probably mere local mutations of widespread Palearctic forms already known. Yet it would seem as if a more thorough exploration must add largely to the species now known, and it is almost incredible that the luxuriant fertile valleys of Kamchatka and the innumerable streams and lakes of that country should not be well populated with mollusks.

There are few species which seem to be common to the shores of Bering Sea, both Asiatic and American, such as *Succinea chrysis*, *Punctum conspectum* and *Anodonta beringiana*. There

is one local species, *Eulota weyrichi*, known only from Sakhalin Island;[1] and another, *Helicigona subpersonata*, from the valley of the Ud. Three forms of *Vivipara* (of which two are probably variants of Chinese forms) are the only local species of the vast Amur valley, or drainage, not known from other regions. Nine specially Kamchatkan species have been described, but about half of them are doubtfully distinct.

The total number of land and fresh water mollusks known from the Amurland, Sakhalin, Kamchatka, the Chukchi Peninsula, and the Asiatic coast north of the Amur and east of the Stanovoi Range, is only eighty-two.

Of these, thirteen are circumboreal species and twelve are supposed to be locally peculiar. The remainder are distributed as follows:

	Percent
Europe and west Siberia	55
Northeast China	22
Common to America	13
Erratic species	10

Of these erratic species a few may be especially mentioned. *Margaritana margaritifera*, as is well known, is absent from the whole of the great northern central region of North America, though it appears in the lower Saskatchewan, the sources of the Missouri, and in eastern Canada, while on the Pacific it ascends at least to latitude 56° N. In eastern Asia it is known from Kamchatka, Sakhalin Island, the upper portion of the Amur basin, and southern Mongolia, but I find no authoritative record of it thence westward to northern and middle Europe. Schrenck did not find it on the lower Amur.

Physa fontinalis is reported from the upper Amur and (in a duck's crop) the desert of Dauria, but is not known from Siberia proper, though common in Europe. There is an entire absence of typical *Physa* throughout east Siberia, so far as reported; and only one species of *Ancylus* or *Unio* is known from east of the Yenisei River of Siberia.

[1] In a recent paper Hugh Fulton describes *Eulota flexibilis* and *E.* (*Euhadra*) *fiscina* n. sp. as "probably" from Sakhalin Island; but this seems to me very doubtful when we consider the size of these shells and the fact that the warmest part of Sakhalin has a mean annual temperature of only 33.4° F. and for six months of the year the mean is below the freezing point. The shells are more probably from Yesso.

Aplexa hypnorum is known from northern Europe, western Siberia, and the Chukchi Peninsula, but has not been reported from eastern Siberia, or the Amur, though abundant in Alaska, and reaching on the Taimyr Peninsula to 73° 30′ north latitude.

Zoögenites harpa is known from northern Scandinavia in Europe; from northeastern America, the Hudson Bay territory and Southeastern Alaska, in America; but in Siberia it is recorded only from the easternmost margin, the Chukchi Peninsula, Bering Island, Kamchatka and the lower Amur. These singularities of distribution must await much more extended knowledge before they can be adequately discussed, but it is believed that to some extent they are due to the transgression of the sea, or of glacial ice, over part of the area in which a species might naturally be expected to occur, thus delaying the occupation of the entire region by the species concerned.

In the following table the distribution is indicated by the headings of the six columns. Varieties are not included when the typical form appears in the table.

Column 'Eur.' includes those forms recorded as found in Europe, including the whole of European Russia and the Caucasus.

Column 'Lena' includes the drainage of the Lena and the whole of Siberia from the Lena westward to the Ural Mountains. It should be noted that a number of species which reach the Lena from the west do not cross the Stanovoi Range.

Column 'Amur' includes the Amur drainage basin, the Island of Sakhalin, and the smaller drainage areas between the Amur and the Stanovoi Range.

Column 'China' includes those forms which, having their center of distribution in China or Japan, extend their range to the drainage basin of the Amur, though often reaching only the southern and eastern part of it.

Column 'Kam.' indicates species belonging to the area included in the Kuril Islands, the Commander Islands, Kamchatka proper, the Chukchi Peninsula, and northeastern Siberia east of the Stanovoi Range and north of Aian.

Column 'Am.' includes those forms found in the Aleutian Islands, northern and northwest America, which also occur on the Asiatic side.

The nomenclature is brought up to date as far as possible. The absence from the list of certain names which appear in the memoirs of Schrenck, Middendorff, and others, is only apparent; they are really present under their revised names. I have accepted Simpson's determination of the Naiades, and retain, for the variety of *Unio pictorum* which occurs in eastern Siberia, the early name adopted by Rössmässler from Ziegler's MS., rather than the very recent one which has been proposed by Westerlund. The list of Amurland mollusks in the Vega Expedition report includes several which belong only to the Lena province or western Siberia and do not occur on the Amur.

The material examined from which this and the preceding tables have been prepared, has been derived from several sources. The collections of the National Museum containing the boreal shells upon which the work of W. G. Binney was partly founded, have been of great help. I have also had the kind coöperation of Dr. J. F. Whiteaves of the Geological and Natural History Survey of Canada. My own collections from 1865 to 1899 in Kamchatka and Alaska have furnished much material. I have also had interesting collections from Messrs. Randolph, McGregor, Stoney, Hepburn, Arnheim, Krause, Palmer and others who have visited Alaska for pleasure or in the Government service. The collections actually made during the Harriman Expedition were more interesting than extensive, but have helped considerably, especially those due to the energy of Prof. Trevor Kincaid, of Seattle, while engaged in his entomological researches.

TABLE III. DISTRIBUTION OF NORTHEAST ASIATIC LAND AND FRESH WATER SHELLS.

Name of Species.	Eur.	Lena.	Amur.	China.	Kam.	Am.
Zoögenites harpa Say	o		o		o	o
Vallonia adela West	o		o		o	
Vallonia pulchella Müller	o	o	o			o
Vallonia costata Müller	o	o	o			o
Helicigona subpersonata Midd.			o			
Hygromia hispida L.	o	o	o			
Hygromia rufescens Penn.	o	o	o			
Hygromia stuxbergi West		o	o			
Eulota arcasiana Crosse			o	o		
Eulota maackii Gerstf.			o	o		
Eulota middendorffii Gerstf.			o	o		
Eulota ravida Benson			o	o		
Eulota schrenckii Midd.	o	o	o		o	
Eulota selskii Gerstf.			o	o		
Eulota weyrichii Schrenck			Sak.			
Pupilla muscorum L.	o	o	o			o
Vertigo alpestris Alder	o	o	o		o	
Vertigo arctica Wall	o	o			o	
Vertigo krauseana Reinh					o	o
Vertigo borealis Morel					o	
Cochlicopa lubrica Müller	o	o	o	o	o	o
Vitrina exilis Morel					o	o
Vitrina pellucida Müller	o	o	o			
Vitrea radiatula Alder	o	o	o		o	o
Euconulus trochiformis Montagu	o	o	o		o	o
Zonitoides arboreus Say			?	o	o	o
Limax agrestis L.	o	o	o		o	o
Limax hyperboreus West	o	o	?		o	o
Arion hortensis Fér	o		o			o
Arion ater L.	o	o	o			
Incilaria bilineata Benson			o	o		
Pyramidula ruderata Studer	o	o	o	o	o	
Punctum conspectum Bland					o	o
Punctum ? floccula Morel					o	
Sphyradium edentulum Drap.	o	o			o	o
Succinea putris L.	o	o	o	o		
Succinea chrysis West					o	o
Lymnæa stagnalis L.	o	o	o		o	o
Lymnæa peregra Müller	o	o	o		o	
Lymnæa auricularia L.	o	o	o	o	o	
Lymnæa ovata Drap.	o	o	o	o	o	o
Lymnæa kamchatica Midd.					o	
Lymnæa palustris Müller.	o	o	o		o	o
Lymnæa truncatula Müller	o	o	o		o	o
Planorbis limophilus West	o	o	o			
Planorbis nitidus Müller	o	o	o			
Planorbis contortus Müller	o	o	o			
Planorbis carinatus Müller	o	o	o			
Planorbis borealis (Lovèn) West	o	o	o		o	o
Planorbis kamchaticus West					o	
Planorbis mõllendorffii Dyb.					o	
Planorbis albůs Müller	o	o	o		o	o
Physa fontinalis L.	o		o	o		

TABLE III. DISTRIBUTION OF NORTHEAST ASIATIC LAND AND FRESH WATER SHELLS. — *Continued.*

Name of Species.	Eur.	Lena.	Amur.	China.	Kam.	Am.
Aplexa hypnorum L.	o	o			o	o
Carychium minimum Müller	o		o			o
Siphonaria thersites Cpr.					o	o
Valvata cristata Müller	o	o	o		o	
Valvata piscinalis Müller	o	o	o	o		
Valvata sibirica Midd.					o	
Valvata stelleri Dybowski					o	
Vivipara limnæoides Schr.			o			
Vivipara prærosa Gerstf.			o	?		
Vivipara ussuriensis Gerstf.			o	?		
Bythinia troscheli Paasch	o				o	
Bythinia kickxii Westend	o	o	o			
Bythinia striatula Benson			o	o		
Melania cancellata Benson			o	o		
Sphærium corneum L.	o	o				
Sphærium lacustre Müller	o	o	o		o	
Sphærium asiaticum Mts.		o	o		o	
Corneocyclas amnica Müller	o				o	
Corneocyclas abdita Hald					o	o
Corneocyclas fontinalis Pfr	o	o	o			
Corneocyclas æquilateralis Pr.					o	o
Corneocyclas sibirica Clessin		o	o			o
Cristaria herculea Midd.			o	o		
Cristaria plicata Leach			o	o		
Anodonta beringiana Midd.		o	o		o	o
Anodonta woodiana Lea			o	o		
Margaritana margaritifera L.	o		o	o	o	o
Unio pictorum L. var. longirostris Rössmässler	o	o	o			

IV. CONCLUSIONS IN REGARD TO THE ALASKAN FAUNA.

The fauna of Alaska, so far as the land and fresh water shells considered in this paper enable us to judge, is composite. The mollusks are characteristic especially of two, and to a much smaller extent of two other, faunas. The former are limited by topographic features. Thus the fauna of boreal Canada, in constantly diminishing number of species, is extended to the northwest, north of the Alaskan Range to Bering Sea on the west and the Arctic Coast on the north.

In like manner the fauna of the northern part of the Pacific States is extended west of the ranges which in the north represent the Rocky Mountains, and between them and the sea, northward into British Columbia and thence westward into Alaska, south of the Alaskan Range, until the last representa-

tives of the fauna disappear among the islands of the Aleutian chain. In British Columbia a few species belong to the valley region between the Rockies and the Cascade Mountains, and do not reach the sea coast, but these are too few to modify perceptibly the general rule, and as a matter of fact they, like the valleys themselves, soon disappear after crossing the 49th parallel.

Very much the same thing is true of the birds, as I was able to demonstrate some thirty five years ago; and even the marine mollusks of the Alaskan coast form a somewhat analogous assembly.

The other two faunas concerned are those (1) of Asia, or rather eastern Siberia, that part of Asia nearest to Alaska, and (2) the Holarctic or circumboreal group of species which are common to the entire boreal zone and characteristic of it, though rather few in number.

In referring to the Canadian fauna it will of course be clearly understood that the fauna of that part of Canada discussed in this paper and not the entire fauna of the whole Dominion is meant. With this reservation we may proceed to discuss the matter from the statistical point of view.

One hundred and forty seven species or strongly marked varieties are enumerated here from the Canadian region as above limited, and fifteen other forms are mentioned which though not known to cross the boundary yet in all probability will eventually be found to do so. By reference to the preceding tables the extension of each species will be found recorded, and the particular localities as far as discoverable are enumerated in the following text. Forty one species are known from the Alaskan extension of this fauna north of the Alaskan Mountains, or characteristic of that part of the territory. Half of these are circumboreal or Holarctic forms.

The fauna of British Columbia, or the British Columbian extension of what I many years ago designated the Oregonian fauna, comprises seventy five species, so far as known, to which in all probability should be added some thirty eight which are known to approach the parallel of 49° from the south and

whicn probably cross it, making a probable total British Columbian fauna of one hundred and thirteen forms. Considering the very small area occupied by this assembly, when compared with the vast expanse populated by the Canadian fauna, the number is notable. Doubtless in both cases future exploration will add a reasonable number not now enumerated or still undescribed by naturalists.

The contributions from the Columbian assembly to the fauna of Alaska south of the Alaskan and west of the Cascade Ranges comprise thirty five known and six probable species, a total of forty one forms probably inhabiting the area referred to. Some of these, however, are common to northern Alaska also, making the proper deduction for which we find sixty five species of land and fresh water mollusks known to inhabit the territory of Alaska, with six or seven more which are likely with further exploration to be credited to it in addition to those now known, even if no undescribed species turn up.

The vast unexplored areas, the uncertainties connected with lists of obsolete names and doubtful identifications, the doubt as to what may be considered specific limits in groups of notorious variability, and especially the frequent absence of specimens from which better deductions might have been drawn than were possible from the extant literature, have all contributed to the difficulties under which this memoir has been prepared. Those who have done work on similar lines will understand, and will view without undue severity, the imperfections which the author only too well realizes, and yet which it was out of his power, in the present state of our knowledge, to avoid. It is hoped, however, that this summary will make the path somewhat easier for those who follow him, and contribute a reasonable share to the better appreciation of the facts of Nature of which it treats. And if, among the hardy explorers of whom our neighbors of Canada are justly proud, this paper serves to stimulate an increased interest in the subject, the author will feel that his endeavors are amply repaid.

SYSTEMATIC CATALOGUE OF LAND AND FRESH WATER MOLLUSKS OF NORTH AMERICA FROM THE REGION NORTH OF THE FORTY-NINTH PARALLEL.

The following annotated catalogue is intended to contain a list of all the species known to inhabit the designated region, with the addition of a few which approach the boundary so closely that it is highly probable that on further search their range will be found to cross it. Names of species belonging to the latter category are preceded by an asterisk.

It is intended that the synonymy which follows the name shall exhibit references to the original description of the species, to a good figure, and to the work in which the synonymy, if at all complicated, may be found most fully set forth. The synonymy of some of the genera mentioned seeming to be in great need of elucidation, an attempt has been made to clear it up. In other cases, where the work has elsewhere recently been done, the generic name and authority alone are cited. For the *Helicidæ* and associated forms I have depended upon the arrangement of Dr. H. A. Pilsbry, the acknowledged master of the subject; and for the Naiades, in like manner, on the 'Synopsis' of Mr. Chas. T. Simpson. Some of the other groups I had previously worked up elsewhere, and have utilized the results in this catalogue.

After the synonymy it has been attempted to state the range of the species geographically, in general terms. This statement is followed by a citation of special localities within the designated region from which the species has been reported, and in those cases in which the writer has verified the report by the examination of specimens, the name of the locality is followed by an exclamation mark.

These data are exemplified or explained by notes following the details of geographical distribution in a separate paragraph.

The data in many cases have been taken from the literature, a bibliography of which concludes this paper; and it follows that the resent writer assumes no responsibility for the identifi-

cation of species so derived. Usually, however, there is no particular reason for doubting the accuracy of these identifications. It has not seemed necessary, in most cases, to cite the authority for the locality, a course which would have unduly increased the bulk and diminished the clearness of the distributional statement. The authority, as a rule, can easily be found by reference to the bibliography. In a few cases, however, it has seemed desirable to include in parentheses the authority for the locality cited, especially when the latter seemed unusual or debatable.

Family HELICIDÆ.

Genus **Helix** (L.) Pilsbry.

Helix (Cepæa) hortensis Müller.

Helix hortensis MÜLLER, Verm. Terr. et Fluv., II, p. 52, 1774. — BINNEY, Land and Fw. Sh. N. Am., I, p. 181, figs. 317–320, 1869.
Helix subglobosa BINNEY, Boston Journ. Nat. Hist., I, p. 485, pl. XVI, 1867.

Range. — Europe from Hungary to the Atlantic between middle Scandinavia and the Pyrenees, northeastern border of North America.

Labrador; Newfoundland; Anticosti Island! Barachois, Gaspé; Cape Breton Island![1] Halifax! Casco Bay, Maine! shore of Cape Ann and adjacent islets, Mass.! Nantucket Island! Pleistocene deposits near Portland, Maine!

A single specimen was once found in Greenland, but was doubtless imported accidentally. The prevalent type is light yellow, without or with only faint traces of bands. The former is Binney's *H. subglobosa.*

FIG. 1. *Helix hortensis* var. *subglobosa* Binney.

The wide distribution of the species, often on uninhabitable islets off a coast little frequented, and its presence, which I have verified, in the glacial Pleistocene of Maine, tend to confirm the view that it is a prehistoric immigrant if an immigrant at all.

I have seen most of the commoner varieties which are prevalent in Europe, but it is obvious to the collector that the brighter colored types with sharply define ddark bands form an insignificant proportion of the American specimens; while the shells as a whole seem smaller than the average dimensions of European specimens.

[1] The exclamation point indicates that specimens from this locality have been seen by me and verified as correctly identified.

Helix (*Arianta*) *arbustorum* L. has been noted as an introduced species, at St. John, Newfoundland, just outside of our region, by Whiteaves.

Genus **Epiphragmophora** Doering.

Epiphragmophora fidelis Gray.

Helix fidelis GRAY, Proc. Zool. Soc. Lond., 1834, p. 67; Conch. Cab., 2d ed., Mon. *Helix*, p. 321, pl. LVII, figs. 12, 13.
Helix nuttalliana LEA, Trans. Am. Phil. Soc., VI, p. 88, pl. XXIII, fig. 74, 1839.
Epiphragmophora fidelis PILSBRY, Class. Cat. N. Am. Landsh., p. 4, 1897.

Range. — Northern California to Sitka, Alaska.

Sumas Prairie, Fraser River valley, B. C. (common to 6,000 ft., J. K. Lord); Chilliwak Lake, B. C.; Victoria! Nanaimo! Comox! on Vancouver Island; Growler Cove, Broughton Strait; Union Bay! False Bay, Lasqueti Id.; Malaspina Inlet; N. point Texada Island, British Columbia; Sitka, Alaska!

The Sitkan and Columbian specimens are apparently not markedly different from those collected further south, and pass through the same color variations. If there is any difference it is that the northern specimens are a little smaller and exhibit no tendency to pilosity. The two specimens obtained at Sitka were found near the Hot Springs. There is no evidence in regard to the distribution of the species north of Sitka, but it would not be surprising if it were eventually found to extend on the outer islands as far north as Cross Sound.

Genus **Zoögenites** Morse.

This group has been united with the *Acanthinula* of Beck, of which, it would seem, little is known but the shell, while we have, thanks to Morse, a very satisfactory account of our mollusk. I prefer therefore to defer any consolidation with *Acanthinula* until it is shown to be necessary. The information to be had from Moquin Tandon in regard to *Acanthinula aculeata* is unsatisfactory and insufficient. Westerlund (1902) has proposed a genus *Aulaca* to contain both (prior) genera!

Zoögenites harpa Say.

Helix harpa SAY, Rep. Long's Exped., II, p. 256, pl. XV, fig. 1, 1824; Binney's Say, p. 29, pl. LXXIV, fig. 1.
Pupa costulata MIGHELS, Proc. Boston Soc. Nat. Hist., I, p. 187, 1844.
Bulimus harpa PFEIFFER, Conch. Cat., ed. II, *Bulimus*, p. 305, pl. LX, figs. 17–19.
Helix amurensis GERSTFELDT, Mém. des Sav. étr., IX, p. 517, pl. I, figs. 26, *a–c*, 1859.

Zoögenites harpa MORSE, Journ. Portland Soc. Nat. Hist., I, p. 32, pl. I, figs. 1–14, 1864; Am. Nat., I, p. 608, figs. 50–51, 1868.
Acanthinula harpa BINNEY, Land and Fw. Sh. N. Am., I, p. 156, figs. 267–9, 1869; Bull. U. S. Nat. Mus. No. 28, p. 185, figs. 181–184, 1885.
Zoögenetes harpa auct. plur.

Range.— Northwestern Scandinavia, northeastern America, British America near Hudson Bay, Southeastern Alaska, and the easternmost margin of Siberia.

Konyam Bay, eastern Siberia; Avacha Bay, Kamchatka! Bering Island, Commander group; lower Amur River region. Klehini, Chilkat Inlet and valley, Alaska; English River, Manitoba! Moose Factory! Hudson Bay; Minnesota; Gaspé; New England; etc.

The peculiarities of the distribution of this curious little mollusk are referred to in the general discussion of the fauna of northeastern Asia.

Genus **Vallonia** Risso.

Vallonia RISSO, Hist. Eur. Mér., IV, p. 101, 1826; *V. rosalia* Risso, pl. 3, fig. 30, = *Helix costata* Müller.
Zurama LEACH, Proofsheets, p. 108, 1819.—TURTON, Man., p. 64, 1831; Gray's Turton, p. 141, 1840.—LEACH, Syn. Moll. Gt. Brit., p. 77, 1852; *H. pulchella* Müller.
Amplexis BROWN, Ill. Conch. Gt. Brit., expl. pl. XLI, figs. 75–79, 1827; *H. pulchella* Müller.
Amplexus BROWN, *op. cit.*, 2d ed., p. 45, 1844.
Chilostoma (sp.) FITZINGER, Syst. Verz., p. 98, 1833.
Circinaria (sp.) BECK, Index Moll., p. 23, 1837.
Glaphyra ALBERS, Heliceen, p. 87, 1850.
Lucena MOQUIN TANDON, Hist. Moll. Terr. et Fluv. France, II, pp. 98, 140, 1855; not of Oken, 1815, or Hartmann, 1821.

Vallonia pulchella Müller.

Helix pulchella MÜLLER, Verm. Terr., II, p. 30, 1774.—BINNEY, Boston Journ. Nat. Hist., III, p. 375, pl. IX, fig. 2, 1840.—W. G. BINNEY, Land and Fw. Sh. N. Am., I, p. 157 (*ex parte*), figs. 270–1, 1869.

FIG. 2. *Vallonia pulchella*, 7/1.

Helix minuta SAY, Journ. Acad. Nat. Sci. Phila., I, p. 123, 1819.—MORSE, Am. Nat., I, p. 544, fig. 39, 1867.
Helix paludosa DACOSTA, Brit. Conch., p. 59, 1778.
Vallonia minuta MORSE, Journ. Portland Soc. Nat. Hist., I, p. 21, figs. 54–56, pl. VIII, fig. 57, 1864.

Range. — Europe; North Africa, southern and western Siberia to the Amur; Madeira; the Azores; eastern North America from Manitoba to Florida and Montana to Nova Scotia.

Manitoba, at Winnipeg and Pembina; north to the Saskatchewan (Richardson). Introduced? in California.

Although Risso's figure of *V. rosalia* represents a perfectly smooth shell, his diagnosis calls for one with elevated lamellæ; it is probable therefore that he regarded the present species and *V. costata* as varieties of a single species.

Vallonia costata Müller.

Helix costata MÜLLER, Verm. Terr., II, p. 31, 1774.
Helix crenella MONTAGU, Test. Brit., I, p. 441, pl. XIII, fig. 3, 1804.
Helix pulchella var. RÖSSMÄSSLER, VII, p. 6, fig. 439, 1838.— FÉRUSSAC, Hist., pl. LXIX E, figs. 15–17, 1821.

Range. — With *V. pulchella* in Europe and Asia; in America in the northern States and northward from Kansas and Colorado.

Manitoba (Hanham).

This species has been so constantly confused with the other costate species and with *V. pulchella* that it is hardly practicable to determine its true range from the literature.

Vallonia gracilicosta Reinhardt.

Vallonia gracilicosta REINHARDT, Sitz. Ber. der Ges. Naturf. Freunde zu Berlin, 1883, No. 3, p. 42. Little Missouri.

Range. — Rocky Mountain region, westward and northward from the upper Missouri.

Manitoba, at Winnipeg; in Alberta at Laggan. Red Deer Olds and McLeod.

Easily recognized by its very prominent, not crowded, very oblique lamellæ.

Vallonia albula Sterki.

Vallonia albula STERKI, Proc. Acad. Nat. Sci. Phila., 1893, p. 263, pl. VIII, figs. D, O; Nautilus, IX, p. 17, May, 1895.

Range. — Eastern Canada to British Columbia.

Quebec; Manitoba; Vancouver Island.

Vallonia asiatica Nevill.

Helix costata var. *asiatica* NEVILL, Sci. Results 2d Yarkand Mission, p. 4, No. 7, 1877.
Vallonia asiatica REINHARDT, Sitz. Ber. der Ges. Naturf. Freunde zu Berlin, 1883, No. 3, p. 42.

Range. — Central Asia, Tibet. Alaska.

Pyramid Island, Lynn Canal, Alaska, *fide* Reinhardt.

This form, collected by Dr. Krause, was identified by Dr. Reinhardt with Nevill's species and is included here solely on his authority, as I have not seen specimens.

Genus **Polygyra** Say.

Polygyra devia Gould.

Helix devia GOULD, Proc. Boston Soc. Nat. Hist., II, p. 165, 1846.—BINNEY, Land and Fw. Sh. N. Am., I, p. 152, fig. 259, 1869.
Helix baskervillei PFEIFFER, Proc. Zool. Soc. London, p. 130, 1849.—REEVE, Conch. Icon., *Helix*, fig. 684, 1852.
Polygyra devia PILSBRY, Class. Cat. N. Am. Landsh., p. 11, 1897.

Range. — Washington and Idaho, north into British Columbia.

Sumas Prairie, B. C.; Esquimalt, Vancouver Island.

Polygyra columbiana Lea.

Helix columbiana LEA, Trans. Am. Phil. Soc., VI, p. 89, pl. XXIII, fig. 75, 1839.—BINNEY, Terr. Moll., II, p. 169, pl. V, 1851.
Helix labiosa GOULD, Proc. Boston Soc. Nat. Hist., II, p. 165, 1846; Expl. Exp. Moll., p. 67, fig. 35, 1852.
Polygyra columbiana PILSBRY, Class. Cat. N. Am. Landsh., p. 11, 1897.

Range. — Monterey Bay, California, to Yakutat Bay, Alaska, in the moist wooded region west of the Rocky Mountains.

Mountains of Idaho, western Montana and Washington; Vancouver Island at Victoria! Nanaimo and Nootka; British Columbia mainland on banks of Fraser River (Lord) and Skeena River! (Osgood); Harbledown and Pender Islands, Johnstone Strait; Union Bay! Port Simpson; and Cumshewa Inlet, Queen Charlotte Islands! B. C.; in Alaska at Cape Fox! Annette Island, Killisnoo, Sitka! Lynn Canal; Biorka Island! Chilkat valley! Lituya Bay! Yakutat!

There are several varieties of this widespread and familiar species. First, the type, subconic rather elevated and small, with narrow reflexed lip. Lea's specimen was decorticated and showed no signs of the hairs with which the shell is usually covered, but this was accidental; some specimens normally show hardly a trace of the hairs which are usually so conspicuous. The second variety, *P. labiosa* Gould, is larger, more depressed relatively, with a broader, somewhat flexuous reflected lip. This form is more prevalent in the interior of Washington, Idaho, etc., and more often has a parietal tooth or trace of a tooth. The variety *santacruzensis* is in form more like the type but much smaller, thin, lighter colored, with a sparser pelage, and about half the specimens have a trace of a parietal tooth, while in a lot of about seven hundred *columbiana*, from Sitka, I found only one specimen

which had any parietal tooth. The mountain forms from California, if not hybrids, are so very different from the hairy coast or lowland shells that one is tempted to regard them as distinct; they frequently are rough, hairless, with heavy lip and well marked parietal tooth. A young specimen of the typical form, collected near Yakutat Village by the Harriman Expedition, is reversed.

Some specimens of this and another species, both of which are confined to wooded regions so far as authentically known, were once sent me as from a point considerably north of Yakutat and from the treeless region. I do not believe these shells were correctly labelled, and hence have not included them in the list of localities. My own impression is that the extension northward of this species and *Circinaria vancouverensis* has been prevented by the wide stretch of glacial area just north and west from Yakutat Bay. I have searched for this species at Prince William Sound and Cook Inlet, in suitable situations, but without success.

Polygyra townsendiana Lea.

Helix townsendiana LEA, Trans. Am. Phil. Soc., VI, p. 99, pl. XXIII, fig. 80, 1839. — BINNEY, Land and Fw. Sh. N. Am., I, p. 164, fig. 285, 1869.

Range.—Puget Sound region and south (to northern California?). Seattle, Wash.; Lake Chilliwak and Sumas Prairie, British Columbia.

Eastward from the moist coast region the following species occurs and is sometimes regarded as a depauperate form of *P. townsendiana*.

* **Polygyra ptychophora** Brown.

Helix ptychophora A. D. BROWN, Journ. de Conchyl., 3me Sér., X, p. 392, Oct., 1870.
Arionta townsendiana var. *ptychophora*, BINNEY, Man. Am. Landsh., p. 129, fig. 102, 1885.

Range. — Western Montana (at Deer Lodge) westward through northern Idaho to Spokane, Wash., and to The Dalles, in northern Oregon.

It is possible that this form may hereafter be found on the northern side of the boundary.

Polygyra germana Gould.

Helix germana GOULD, U. S. Expl. Exp., Moll., p. 70, fig. 40, *a–c*, 1852.
Stenotrema germanum (GOULD) BINNEY, Man. Am. Landsh., p. 114, fig. 82, 1885.

Range.—Northern California, through the Puget Sound region to British Columbia.

Astoria, Oregon! Victoria, Vancouver Island; Chilliwak Lake, British Columbia.

A variety *megasoma*, more than four times the size of the typical *germana*, but otherwise quite similar, is occasionally found; some from northern California (Stearns) are in the National Museum.

Polygyra monodon Rackett.

Helix monodon RACKETT, Trans. Linnean Soc., XIII, p. 42, pl. V, fig. 2, 1822. — MORSE, Am. Nat., I, p. 151, figs. 12, 13, 1867. — BINNEY, Land and Fw. Sh. N. Am., I, p. 120, figs. 200–205, 1869.

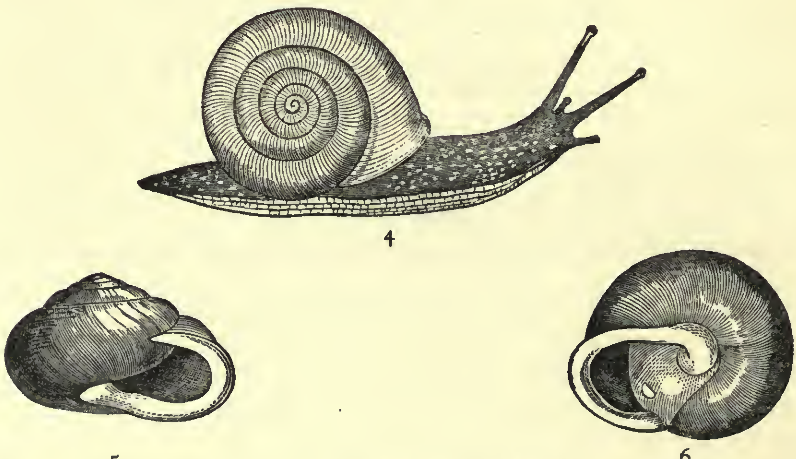
FIG. 3. *Polygyra monodon* Rackett.

Range. — Eastern United States, east of the plains region, from Texas to Minnesota and northward. Moose Factory, James Bay!

Polygyra albolabris Say.

Helix albolabris SAY, Nicholson's Encycl., 1st Am. ed., pl. I, fig. I, 1817; Am. Conch., II, pl. XII, 1831. — MORSE, Am. Nat., I, p. 6, pl. I, figs. 1–11, 1867. — BINNEY, Land and Fw. Sh. N. Am., I, p. 136, figs. 229–232, 1869.

Range. — Eastern United States, from Georgia and Arkansas northward to the Saskatchewan.



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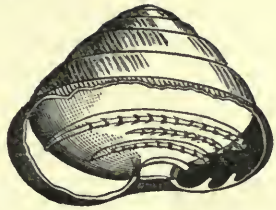
FIGS. 4–6. *Polygyra albolabris* Say, ½.

Lake Superior region; Lake Winnipeg, Manitoba; and northward to the Saskatchewan River (Richardson).

Family PUPIDÆ.

Genus **Strobilops** Pilsbry.



7. Animal from above. 8. $\frac{3}{1}$. 9. Showing internal lamellæ.

FIGS. 7–9. *Strobilops labyrinthica* (magnified).

Strobilops labyrinthica Say.

Helix labyrinthica SAY, Journ. Acad. Nat. Sci. Phila., I, p. 124, 1817. —MORSE, Am. Nat., I, p. 145, figs. 41–42, 1867. — BINNEY, Land and Fw. Sh. N. Am., I, p. 84, figs. 150–154, 1869.
Strobila labyrinthica MORSE, Journ. Portland Soc. N. Hist., I, p. 26, figs. 64–67, pl. II, fig. 12, *a–b*, pl. VIII, fig. 68, 1864.
Strobilops PILSBRY, 1892, new name for *Strobila* Morse, 1864, not Sars, 1835.

Range.—Eastern United States, from Texas northward to British America.

Carberry, Manitoba; Moose Factory, James Bay!

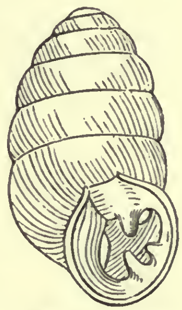


FIG. 10. *Bifidaria armifera* (magnified).

Genus **Bifidaria** Sterki.

Bifidaria armifera Say.

Pupa armifera SAY, Journ. Acad. Nat. Sci. Phila., II, p. 162, 1821.— GOULD, Boston Journ. Nat. Hist., III, p. 400, pl. III, fig. 10, 1840.—BINNEY, Land and Fw. Sh. N. Am., I, p. 241, fig. 419, 1869.

Range. — The United States east of the Rocky Mountains, and Canada.

Red Deer, Alberta; Brandon, Manitoba.

FIG. 11. *Bifidaria contracta* (magnified).

Bifidaria contracta Say.

Pupa contracta SAY, Journ. Acad. Nat. Sci. Phila., II, p. 374, 1822. — GOULD, Boston Journ. Nat. Hist., III, p. 399, pl. III, fig. 22, 1840. — BINNEY, Land and Fw. Sh. N. Am., I, p. 242, figs. 420–422, 1869.

Range. — Eastern North America from Mexico to British America, east of the Rocky Mountains.

Carberry, Manitoba.

Bifidaria holzingeri Sterki.

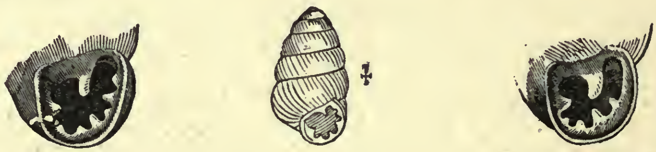
Pupa holzingeri STERKI, Nautilus, III, No. 4, p. 37, Aug., 1889. — BINNEY, Bull. Mus. Comp. Zool., XIX, No. 4, p. 193, fig., p. 194, 1890.
Bifidaria holzingeri PILSBRY, Class. Cat., p. 19, 1898.

Range. — Illinois and Kansas, northward to British America.

Red River drift, Brandon, Manitoba; Red Deer, Alberta.

Bifidaria pentodon Say.

Vertigo pentodon SAY, Journ. Acad. Nat. Sci. Phila., II, p. 376, 1822.
Pupa pentodon GOULD, Boston Journ. Nat. Hist., IV, p. 353, pl. XVI, figs. 10–11, 1843. — BINNEY, Land and Fw. Sh. N. Am., I, p. 236, figs. 405–409, 1869.



a *b* *c*

FIG. 12. *Bifidaria pentodon* (magnified), showing variations in aperture.

Range. — Eastern United States from Texas to British America; southeastern Nevada, Quebec; Ontario; Manitoba (rare); Alberta, at Laggan.

Genus **Pupilla** (Leach) Turton.

Pupilla blandi Morse.

FIG. 13. *Pupilla blandi* (magnified).

Pupilla blandi MORSE, Ann. N. Y. Lyc. Nat. Hist., VIII, p. 211, fig. 8, 1865.
Pupa blandi BINNEY, Land and Fw. Sh. N. Am., I, p. 235, fig. 402, 1869.
? *Pupa signata* WESTERLUND, 1885, not of Mousson.

Range.—Upper Missouri, Rocky Mountains; New Mexico to Colorado; Canada; Red Deer, Alberta.

Pupa signata was described from the Caucasus, and its inclusion by Westerlund in a list of American Arctic species is probably an oversight.

Pupilla muscorum Linné.

Turbo muscorum LINNÉ, Syst. Nat., ed. X, p. 767, 1758; ed. XII, p. 1240, 1767. — HANLEY, Shells of Linn., p. 352, pl. IV, fig. 6, 1855.
Pupa muscorum var. *bigranata* RÖSSMÄSSLER, *fide* Westerlund.
Pupa badia ADAMS, Boston Journ. Nat. Hist., III, p. 331, pl. III, fig. 18, 1840.
Pupilla badia MORSE, Journ. Portland Soc. N. Hist., I, p. 37, figs. 89–91, pl. X, fig. 92, 1864.
Pupa muscorum var. *lundstromi* WESTERLUND, Ges. Nat. zu Berlin, p. 36, Mar., 1883.

Pupa (*Pupilla*) *muscorum* PILSBRY, Nautilus, XI, p. 118, Feb., 1898.
Pupa sublubrica Aucey, *fide* Binney.

Range.— Europe. In America, New England and Canada; Anticosti; the northern United States as far west as Montana, alpine

14 15 16

FIGS. 14–16. *Pupilla muscorum*, showing variations. Fig. 16 from a European specimen. Fig. 14 from *P. badia* Adams. Fig. 15 maximum armature of mouth. (All magnified.)

(8,000–9,000 feet) in Colorado, Utah and Nevada; northward in British America.

Laggan, Alberta; Anuk, Alaska.

Genus **Vertigo** Müller.

Vertigo hoppii Möller.

Pupa hoppi MÖLLER, Ind. Moll. Grönl., p. 4, 1842. — PFEIFFER, Conch. Cat., ed. II, *Pupa*, p. 163, pl. XIX, figs. 29, 30, 1852. — TRYON, Ann. Journ. Conch., III, p. 303, pl. XV, fig. 3, 1867.
Pupa (*Vertigo*) *hoppii* MÖRCH, Am. Journ. Conch., IV, p. 30, pl. III, figs. 6–9, 1869.
Pupa steenbuchi BECK, Verz. Kiel., p. 76, 1847; *nomen nudum*, *fide* Mörch, *op. cit.*

Range.— Greenland (Ungava, Labrador?).

The references to this species as found in Alberta and Anticosti are doubtless based on a different species, as is Binney's figure on page 235 of the Land and Fresh Water Shells, part I.

Vertigo modesta Say.

Pupa modesta SAY, Rep. Long's Exp., II, p. 259, pl. XV, fig. 5, 1824.
Pupa decora GOULD, Proc. Boston Soc. Nat. Hist., II, p. 263, fig., 1848.
Vertigo parietalis ANCEY; *P. corpulenta* MORSE, and *V. castanea* STERKI, *fide* PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1900, pp. 597–602, pl. XXIII, figs. 1–7, 1900.

Range. — North America from New England to California and northward. Loess of Iowa.

Ungava, Labrador! Lake Superior region; Laggan, Alberta; in British Columbia at Nanaimo and Victoria; in Alaska at Killisnoo, Chilkat and Chilkoot valleys, Pyramid Island, Portage Bay, Dyea, Klukwan, Point Romanof at the Yukon delta; St. George Island! St. Paul Island! Unalaska! Rooluk Island, Unalga Pass! Akutan Island! Popof Island, Shumagins! St. Paul, Kadiak Island! Orca, Prince William Sound! Yakutat Bay! Berg Inlet, Glacier Bay! Muir Inlet!

This is the most abundant and widely distributed species in the north country. I have very little doubt that *V. borealis* Morelet, from Kamchatka and Bering Island, is merely a variety of this species.

Vertigo columbiana Sterki.

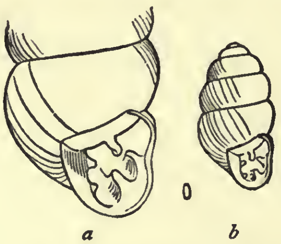
Vertigo columbiana (STERKI MS.) PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1900, p. 602, pl. XXIII, fig. 11, Sept., 1900.

Range. — Douglas County, Oregon, and northward to Washington, Vancouver Island, and St. Paul Island, Bering Sea!

Resembles *V. gouldii* but wants the basal fold. A variety occurs in Utah. The St. Paul specimen was identified by Dr. Sterki.

Vertigo gouldii Binney.

Pupa gouldii BINNEY, Proc. Boston Soc. Nat. Hist., I, p. 105, 1843; Terr. Moll., II, p. 332, pl. LXXI, fig. 2, 1851.



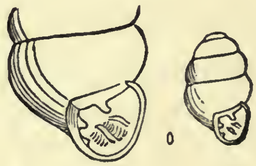


FIG. 17. *Vertigo gouldii* (magnified). FIG. 18. *Vertigo bollesiana* (magnified).

Vertigo gouldii MORSE, Am. Nat., I, p. 669, fig. 60, 1868. — Journ. Portland Soc. N. Hist., I, p. 38, fig. 95, pl. X, fig. 96, 1864.

Vertigo bollesiana MORSE, Ann. N. Y. Lyc. Nat. Hist., VIII, p. 209, figs. 4–6, 1865.

Vertigo bollesiana var. *arthuri* VON MARTENS, Sitz-ber. Ges. Naturf. Fr. zu Berlin, 1882, No. 9, p. 140.

Range. — Northern United States east of the Rocky Mountains and northward.

Ottawa, Ontario; Manitoba; Upper Missouri at Fort Berthold; Helena, Montana.

The variety *arthuri* is catalogued from Arctic America by an oversight, in Binney's Third Supplement, p. 185. It is really from the Little Missouri in Dakota.

Vertigo ventricosa Morse.

Isthmia ventricosa MORSE, Ann. N. Y. Lyc. N. Hist., VIII, p. 1, figs. 1–3, 1865.
Vertigo ventricosa MORSE, Am. Nat., I, p. 966, figs. 61, 62, 1868.
Vertigo ventricosa elatior STERKI, Nautilus, XI, p. 120, Feb., 1898.
Vertigo gouldii lagganensis PILSBRY, Proc. Acad. Nat. Sci. Phila, for 1899, p. 314, fig. 1.
Vertigo approximans STERKI, *fide* Pilsbry.

Range. — Quebec and Maine to Illinois and Alberta; Manitoba; variety *elatior* at Laggan, Alberta.

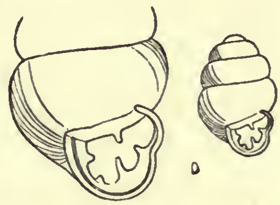


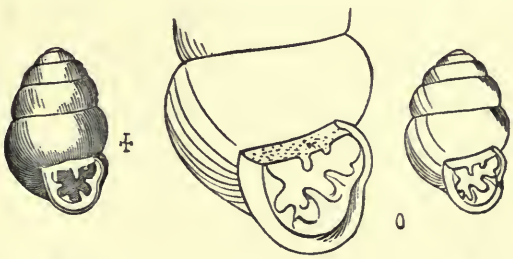
FIG. 19. *Vertigo ventricosa* (magnified).

Vertigo binneyana Sterki.

Vertigo binneyana STERKI, Proc. Acad. Nat. Sci. Phila., for 1890, p. 33; Nautilus, III, p. 125, March, 1890. — PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1899, p. 315, fig. 2; Nautilus, IV, p. 39, pl. 1, fig. 1, Aug., 1890.

Range. — Rocky Mountain region from Albuquerque, New Mexico, to Manitoba.

Seattle, Wash.; Helena, Montana; Winnipeg, Manitoba.



FIGS. 20–22. *Vertigo ovata*, showing variations in teeth (see next page).

23*a* 23*b* 23*c*

FIG. 23. *Vertigo ovata*, showing variations in teeth of aperture (all figures magnified).

Vertigo ovata Say.

Vertigo ovata SAY, Journ. Acad. Nat. Sci. Phila., II, p. 375, 1822. — MORSE, Am. Nat., I, p. 668, figs. 57, 58, 1868. — BINNEY, Land and Fw. Sh. N. Am., I, p. 252, figs. 442–445, 1869 (syn. in part excl.).

Range. — Eastern United States from Maine to Texas, and northward. Mexico?

Ungava Bay, Labrador! Victoria, British Columbia! St. Paul, Kadiak Island! Alaska; Tigalda Island, Aleutian chain! Laggan, Alberta; Manitoba.

Vertigo arctica Wallenberg.

Pupa arctica WALLENBERG, Mal. Blätt, v, pp. 32, 99, pl. I, figs. 3, *a–c*, 4, 1858. — REINHARDT, Sitz-ber. Ges. Naturf. Fr. zu Berlin, No. 3, 1883, p. 38.

Range. — Lapland and northern Scandinavia, the mountains of Germany and the Tyrol; eastern Siberia at Emma Harbor, Plover Bay; Port Clarence on the American side of Bering Strait (Vega Expd.).

***Vertigo krauseana** Reinhardt.

Vertigo krauseana REINHARDT, Sitz-ber. Ges. Naturf. Fr. zu Berlin, No. 3, 1883, p. 38. — WESTERLUND, Fauna Pal. Reg., III, p. 131, 1887.

Range. — Chukchi Peninsula of eastern Siberia; at Poot, St. Lawrence Bay, and Ratmanof Harbor. Alaska, at Chilkat Inlet!

Specimens of this species labeled Chilkat Inlet were received from Dr. Krause; but in the publications on this form only the Siberian habitats are given. I suspect some error has occurred in labeling, though it is entirely possible that the species may occur in Arctic America.

***Vertigo (Vertilla) milium** Gould.

Pupa milium GOULD, Boston Journ. Nat. Hist., III, p. 402, pl. III, fig. 23, 1840.
Vertigo (*Angustula*) *milium* STERKI, Proc. U. S. Nat. Mus., XI, pp. 377–8, pl. XLII, figs. 10, 13, 1888.

Vertigo (*Vertilla*) *milium* PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1900, p. 597.

Range. — New England to Texas and Florida, west to Minnesota. Ontario, Canada.

This minute species doubtless exists on the northern side of the boundary, though not yet reported there.

FIG. 24. *Vertigo milium* (magnified).

*** Vertigo (Isthmia) pygmæa** Draparnaud.

Pupa pygmæa DRAPARNAUD, Tableau, p. 57, 1801; Hist. Moll. Terr., p. 60, pl. III, figs. 20–21, 1805.
Vertigo pygmæa PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1900, p. 608.
Vertigo callosa STERKI, not Reuss, and *P. superioris* Pilsbry, *fide* Pilsbry, l. c.

Range. — Europe, Asia Minor, the Caucasus; America, in the northeastern States and the Lake Superior region.

Family ACHATINIDÆ.

Genus Cochlicopa (Férussac) Risso.

Cochlicopa lubrica Müller.

Helix lubrica MÜLLER, Verm. Hist., I, p. 104, 1774.
Zua lubrica LEACH, Syn. Moll. Gt. Brit., p. 114, 1852; Gray's Turton's Man., p. 188, pl. VI, fig. 65, 1840.
Cionella lubrica JEFFREYS, Trans. Linn. Soc., XVI, p. 347, 1830. — BINNEY, Land and Fw. Sh. N. Am., I, p. 224, figs. 381–385.
Bulimus lubricoides STIMPSON, Shells of New England, p. 54, 1851.
Zua lubricoidea MORSE, Jour. Portland Soc. Nat. Hist., I, p. 30, figs. 79, 81, 84; pl. X, fig. 82, 1864; Am. Nat., I, p. 607, fig. 49, 1868.
Ferussacia subcylindrica auct. non L.

Range. — Europe, North Africa and Asia Minor: Siberia; Kamchatka; most of North America.

Lake Superior region; Red River of the North, Lake of the Woods and Turtle Mountain, Manitoba; Moose Factory! English River, Keewatin; Laggan and Red Deer in Alberta; Nanaimo and Victoria, British Columbia; Point Barrow! and Yukon valley, Alaska; Avacha Bay! Kamchatka.

This well known shell is one of the most emphatically circumpolar species in existence, and considering its immense geographical and climatic range its resistance to the factors which make for variation is very remarkable.

Family CIRCINARIIDÆ.

Genus Circinaria Beck.

This is *Macrocyclis* or *Selenites* of recent literature, not of Beck or Hope.

Circinaria vancouverensis Lea.

Helix vancouverensis LEA, Trans. Am. Phil. Soc., VI, p. 87, pl. XXIII, fig. 72, 1839.
Helix vellicata FORBES, Proc. Zool. Soc. London, 1850, p. 75, pl. IX, fig. 1.
Macrocyclis vancouverensis TRYON, Am. Journ. Conch., II, p. 245, pl. III, fig. 6, 1866. — BINNEY, Land and Fw. Sh. N. Am., I, p. 54, figs. 90–93, 1869.
Selenites vancouverensis BINNEY, Third Suppl. Terr. Moll. pp. 163–6, 1892.
Circinaria vancouverensis PILSBRY, Class. Cat. Am. Landsh., p. 24, 1898.

Range. — In the moist and wooded region of northern California and northward to the Alexander Archipelago, Alaska, between the Cascade Range and the sea.

Vancouver Island! Quatsino Sound, Broughton Strait, Malcolm Island, Johnstone Strait, Harbledown and Pender Islands, Skidegate, Graham Island, and Cumshewa Inlet, Moresby Island, Queen Charlotte Islands! Union Bay! and Comox! British Columbia. In Alaska at Annette Island! Killisnoo, Sitka! Lynn Canal, throughout the Alexander Archipelago, and northward along the mainland shore to Lituya Bay.

The typical form of this species is readily recognizable by its ample whorls, the last nearly smooth, its large size and greenish yellow color. It grades, however imperceptibly, into the smaller and more strongly sculptured *C. sportella* Gould, from which cause a large number of varieties have arisen and been named. In the moist mountainous region of the Columbia drainage some of these forms penetrate to the eastward nearly to the headwaters of this river in western Montana. They are all depauperate, however, compared with the typical well nourished forms of the coast. These animals are carnivorous, voracious and cannibalistic. It is unsafe to keep them living in the same receptacle with other living snails, as they will rapidly destroy and consume the soft parts.

A fine sinistral specimen was collected at Sitka.

A variety of a dark chocolate brown color, otherwise like the ordinary form, was found rather commonly at Sitka. For this the varietal name *chocolata* would seem appropriate.

Specimens of this species were received with a label indicating that they had been collected on the Alaska Peninsula opposite Kadiak Island, but, knowing the habits of this animal, I regard this as an error of labelling. The collector having died, I was unable to untangle the confusion, but I have never found it far distant from the wooded region where *Ariolimax* and *Polygyra columbiana* occur, upon which it chiefly feeds in Alaska. It does not occur, so far as I was able to discover, on the shores of Cook Inlet, where there are suitable forests,

and I do not believe it occurs on the treeless grassy slopes of the peninsula. I suspect that the wide-stretching glacial area to the north and west of Yakutat Bay, puts an impassable barrier to its northwestern migration, and that it may not exist in the forests beyond that area.

This is the largest shell-bearing Pulmonate known to live in Alaska, but is surpassed by the great slug *Ariolimax*, which often extends to the length while preserving the diameter of a large cigar.

Circinaria variety **sportella** Gould.

Helix sportella Gould, Proc. Boston Soc. Nat. Hist., II, p. 167, 1846; Moll. U. S. Expl. Exp., p. 37, fig. 42, 1852.

This is a variety of *C. vancouverensis* of smaller size, and intensified sculpture, both spiral and incremental. Intermediate forms, to which several names have been applied, connect it with the typical form. It accompanies the latter throughout its range, but occurs in some localities which do not support the larger form. Among northern localities it has been collected at Saanich, Comox! Union Bay! Salt Springs Island and Chilliwak Lake, British Columbia; at Annette Island! (with variety *hybrida* Ancey) and Lituya Bay! Alaska.

Circinaria variety **hybrida** Ancey, 1888.

This form is reported from Vernon and Comox, British Columbia, and Annette Island, Alaska.

Circinaria hemphilli Binney and *C. voyana* Newcomb, have not been authentically reported north of the boundary, though it is said both of them have been collected in the Puget Sound region.

Family ZONITIDÆ.

Genus Vitrina Draparnaud.

Vitrina DRAPARNAUD, Tabl. Moll. Terr. France, pp. 33, 98, 1801; Hist., Nat. Moll. Terr. France, pp. 23, 30, 119, 1805. Type *Helix pellucida* Müller, Verm. Terr., p. 215.

Vitrinus MONTFORT, Conch. Syst., II, p. 238, 1810.

Cobresia JAC. HÜBNER, Mon. Test. Bairische Landschn. Cobresien, 1810; (pages and plates not numbered).

Hyalina STUDER, Syst. Verz. Schweiz. Conch., p. 11, 1820: not of Schumacher, 1817.

Limacina HARTMANN, Neue Alpina, I, p. 206, 1821; Sturm's Deutschl. Fauna, abth. VI, heft V, pp. 41, 54, 1821; not of Cuvier, 1817.

Helicolimax FÉRUSSAC père, Mém. Soc. Med. d'Emul., IV, p. 390, 1802; et fils, Tabl. Syst. des Lim., pp. 19, 21, 1821.

Semilimax FÉRUSSAC père, Der Naturforscher (Halle), pt. 28, 1802, *fide* Férussac fils, *loc. cit.*, 1821.

Semilimax STABILE, Révue et Mag. Zool. (Guerin), Aug., 1859, p. 41; Moll. Terr. Viv. Piém., p. 23, 1864.—KOBELT, Cat. der Europ. Faun. leb. Binnenconch., p. 3, 1871 (as a section of *Vitrina*, group of *V. diaphana* Drap.). — PFEIFFER, Nom. Hel. Viv., p. 26, 1878.

Pagana GISTEL, Naturg. Thierr., p. 168, 1848 (new name for *Vitrina* Drap.).

Phenacolimax STABILE, Rév. et Mag. Zool. (Guerin), Aug., 1859, p. 42; Moll., Terr. Viv. Piém., p. 24, 1864.— PFEIFFER, Nom. Hel. Viv., p. 27, 1878.

Helicolimax KOBELT, Cat. der Europ. Faun. leb. Binnenconch., p. 4, 1871, (Sect. of *Vitrina*, s.s.).

Trochovitrina SCHACKO, in Boettger, Jahrb. Deutsch. Mal. Ges., VII, p. 379, Oct., 1880; type *Vitrina lederi* Boettger.

Gallandia BOURGUIGNAT, Descr. Nouv. Genre *Gallandia*, Aug., 1880, pp. 4–8, 1st sp. *Vitrina conoidea* Martens.

Oligolimax FISCHER, in Paulucci, Faun. Calabria, p. 37, 1880. — PAULUCCI, Bull. Soc. Mal. Ital., VII, p. 75, 1881. — FISCHER, Man. de Conchyl., p. 464, 1883 (*V. pauluccia* Fischer).

Parmacellina SANDBERGER, Land u. Sussw. Conch. d. Vorwelt, p. 232, pl. XIII, 1871. Sole ex. *P. vitrinæformis* Sandb., Eocene.

Vitrina PILSBRY, Class. Cat. Landsh. Am., p. 25, 1898.

Chlamydea WESTERLUND, Fauna d. Pal. Reg., I, p. 19, 1886 (*V. bicolor* Westerlund, 1881).

The shell in this group and its allies is reduced to very simple terms and the differences between species appear trifling. But there appears to be quite a wide range of character in the soft parts, from whence it follows that several sections can be recognized in the genus as restricted, while some species, formerly regarded as belonging to *Vitrina*, are now scattered in widely separated genera.

The true *Vitrina* seems confined to the northern hemisphere. The following sections are recognized:

Vitrina Drap. s. s. 1801. Type *V. pellucida* Müller. *Helicolimax* Férussac père, 1801, is identical, and *Semilimax* Stabile hardly separable.

Oligolimax Fischer. Type *V. paulucciæ* Fischer.

Phenacolimax Stabile, 1859. Type *V. major* Fér.

Gallandia Bourguignat, Aug., 1880. Type *V. conoidea* von Martens. *Trochovitrina* Schacko, Oct., 1880, is synonymous.

The North American and Greenland species are true *Vitrina*, the other forms belong to the Old World only.

The New World groups *Vitrinozonites* Binney and *Velifera* Binney may be regarded as of generic rank, and are extra limital to the region now under discussion.

Vitrina angelicæ Beck.

Vitrina angelicæ BECK, Index, p. 1, 1837; name only.—MÖLLER, Index, p. 4, 1842.—MÖRCH, Am. Journ. Conch., IV, p. 27, pl. III, figs. 1, 4, 1868. — MÖRCH, in Rink's Danish Greenland, p. 436, 1877.

Helix pellucida FABRICIUS, Fauna Grönl., p. 389, 1780, not of Müller, 1774.

Range. — Greenland.

This species is more like the *V. beryllina* of Europe than the American species. The latest data given by Posselt indicate that it is not found in Iceland. Binney has given an enlarged illustration of this species (fig. 25) in his Land and Fresh Water Shells of North America, I, p. 28.

FIG. 25. *Vitrina angelicæ*, ¹⁄₁.

Vitrina limpida Gould.

Vitrina pellucida DE KAY, Zool. N. Y. Moll., p. 25, pl. III, fig. 42, 1843; not of Müller, 1774.

Vitrina limpida GOULD, in Agassiz, Lake Superior, p. 243, 1850. — MORSE, Journ. Portland Soc. Nat. His., I, p. 11, pl. V, fig. 17, 1864. — BINNEY, Land and Fw. Sh. N. Am., I, p. 27, figs. 23, 24, 1869.

Vitrina americana PFEIFFER, Proc. Zool. Soc. Lond., for 1852, p. 156; Conch. Cab., ed. II, *Vitrina*, p. 9, pl. I, figs. 22–25, 1854.

FIG. 26. *Vitrina limpida* (Maine), ¹⁄₁.

Range. — Central New York and northward, from New Brunswick to Alberta and Hudson Bay.

Pittsburgh, Pennsylvania. Manitoba at Carberry and Lake of the Woods; Red Deer and Laggan in Alberta; Moose Factory! James Bay; Norway House, in damp woods.

This species has been reported from the Rocky Mountain region by Ingersoll, but I regard his specimens so identified as varieties of *V. alaskana*.

Vitrina alaskana Dall, *nom. nov.*

Vitrina pfeifferi NEWCOMB, Proc. Cal. Acad. Sci., II, p. 92, 1861. — TRYON, Am. Journ. Conch., II, p. 244, pl. III, fig. 3, 1866. — BINNEY, Land and Fw. Sh. N. Am., I, p. 28, fig. 26, 1869. Not *V. pfeifferi* Deshayes, in Fér., Limaçons, 1822.

Range. — New Mexico, Utah, Colorado, central California, all at considerable altitudes, and northward.

Nanaimo, Vancouver Island, B. C.; Muir Inlet, Alaska! St. Paul, Kadiak Island! Popof and Unga Islands, of the Shumagin group! Akutan! Unalga! Rooluk! and Unalaska! of the Aleutian chain; St. Paul! and St. George Islands, Bering Sea, Alaska, in tall grass of bluff fifty feet above the sea!

This species has been referred to as *pellucida*, *limpida* and *exilis*, and when fully grown under favorable conditions the shell may reach 10 mm. in major diameter, though most of the specimens as collected are considerably smaller. The shell is translucent, with a marked greenish tinge, and not over three whorls. It is flatter than *limpida*,

larger, and of a different tint, and the size of the whorls increases more rapidly. It is less flat and much larger than *V. exilis*, which is also of a different hue.

It is the most common land shell on most of the islands of Bering Sea and on the continent near the sea, where it usually occurs, but as we move southward we find it occurring at continually greater elevations and entirely absent from the warm dry plains and valleys. It attains from 7,500 to 10,800 feet elevation in the Sierra and Rocky Mountains.

* **Vitrina exilis** Morelet.

Vitrina exilis MORELET, Journ. de Conchyl., VII, p. 8, 1858.— PFEIFFER, Mon. Hel. Viv., IV, p. 799, 1859. — BINNEY, Bull. U. S. N. Mus., No. 28, p. 178, fig. 172, 1885; Terr. Moll., V, pp. 138, 200, pl. II, fig. B.

Range. — Northeastern Asia and adjacent islands, from Japan northeastward.

Kamchatka, at Petropavlovsk! Bering Id. (Vega Expd.).

This is a small species, of a whitish or translucent glassy hue; smaller and with a more elevated spire than its American representative *V. alaskana*. According to Binney *V. exilis* has the jaw and radula as usual in the genus, the transverse rows of teeth numbering 37 . 1 . 37, with seven perfect laterals.

I have seen no specimens from east of the Commander Islands; the shells thus identified are probably all *V. alaskana*.

Genus **Vitrea** Fitzinger.

Vitrea radiatula Alder.

Helix radiatula ALDER, Cat. Test. Newcastle upon Tyne, p. 12, No. 50, 1830. — GRAY, in Turton's Man., p. 173, pl. XII, fig. 137, 1840.
? *Helix hammonis* STRÖM, Trondj., Selsk. Skrift., p. 435, pl. VI, fig. 16, 1765.
? *Zonites viridulus* MENKE, Syn., ed. II, p. 137, 1830.
Helix electrina GOULD, Inv. Mass., p. 183, fig. 111, 1841.
Hyalina viridula BINNEY, Land and Fw. Sh. N. Am., I, p. 34, figs. 41–43, 1869; not of Menke?
Hyalina pellucida LEHNERT, Science Record, II, p. 172, June 16, 1884.

Range.—Holarctic. Northern Europe, Asia and America.

Manitoba, at Lake of the Woods, Carberry and Pembina; Alberta, at Laggan and Red Deer; Fort Resolution, Great Slave Lake! British Columbia, at Departure Bay! Comox! and Union Bay! Alaska, at Killisnoo! Klukwan! Portage Bay! Seduction Tongue! Anuk! St. Paul, Kadiak Island! Unga Island, Shumagins! Unalaska, Aleutians! Nulato, Yukon River! Point Barrow! Bering Island, Bering Sea! Petropavlovsk, Kamchatka!

The species as described by Ström is unrecognizable and his name should be rejected. There is some doubt as to whether the *Z. viridula* of Menke is identical with the present species or not.

Vitrea nitidula Draparnaud.

Helix nitidula DRAPARNAUD, Hist. Moll., p. 117, pl. VIII, figs. 21–22, 1805.
Zonites nitidulus GRAY, in Turton, Man., p. 172, pl. XII, fig. 136, 1840.

Range. — Europe, northern and middle; Italy.

Fort Resolution! Great Slave Lake (Kennicott).

The identification and locality are indubitable.

Vitrea binneyana Morse.

Hyalina binneyana MORSE, Journ. Portland Soc. Nat. Hist., I, p. 13, figs. 25, 26, pl. II, fig. 9, pl. IV, fig. 31, 1864. — BINNEY, Land and Fw. Sh. N. Am., I, p. 39, figs. 56–8, 1869.
Helix morsei TRYON, Am. Journ. Conch., I, p. 188, 1865.
Hyalina binneyi BINNEY, Land and Fw. Sh. N. Am., I, p. 39, footnote.
Vitrea binneyana PILSBRY, Class. Cat., p. 26, 1898.

FIG. 27. *Vitrea binneyana* Morse.

Range.—Quebec and Maine to northern Michigan and British Columbia.

Brandon, Manitoba; Nanaimo, B. C.

Vitrea indentata Say.

Helix indentata SAY, Journ. Acad. Nat. Sci. Phila., II, p. 372, 1822. — GOULD, Inv. Mass., p. 181, fig. 109, 1841.
Hyalina indentata MORSE, Journ. Portland Soc. Nat. Hist., I, p. 12, fig. 21; pl. II, fig. 11, pl. V, fig. 22, 1864. — BINNEY, Land and Fw. Sh. N. Am., I, p. 35, figs. 44–46, 1869.

Range. — Mexico to Manitoba, United States and Canada, eastward from the Rocky Mountains. Pine Creek, Manitoba.

Genus **Euconulus** Reinhardt.

Helix (sp.) MÜLLER, Gmelin, Montagu, Draparnaud, *et al.*, 1774–1820.
Trochus (sp.) DA COSTA, Brit. Conch., p. 35, 1778.
Teba (sp.) LEACH, Proofsheets, 1820, *fide* Rössmässler Icon., II, p. 38, 1838.
Conulus FITZINGER, Syst. Verz. Weichth., p. 94, 1833; not *Conulus* Rafinesque, Analyse de la Nature, p. 145, 1815.
Polita (sp.) HELD, Weichth. Bayerns, Isis, Dec., 1837, col. 916.
Petasia (sp.) BECK, Index, p. 21, 1837.
Zonites (sp.) MOQUIN TANDON, Moll. de France, p. 68, 1855.
Hyalina (sp.) VON MARTENS' Albers, p. 73, 1850. — BINNEY, L. & Fw. Sh. N. Am., pt. I, p. 46, 1869.
Euconulus (*fulvus*) REINHARDT, Sitzb. Ges. Naturf. Fr. zu Berlin, for 1883, p. 86. — PILSBRY, Nautilus, XIV, Nov., 1900, p. 81. — WOODWARD, Brit. Nonmarine Moll., p. 353, 1903.
Hyalinia (sp.) MÖRCH, Syn. Moll. Terr. Dan., p. 14, 1864. — WESTERLUND, Nachrichtsbl. Mal. Ges., XV, p. 173, Dec., 1883.

Arnouldia BOURGUIGNAT, Bull. Soc. Mal. de France, VII, p. 328, 1890.
Vitrea (sp.) E. A. SMITH, Journ. Conch. (Leeds), VI, p. 339, 1891.
Trochulus WESTERLUND, Fauna Pal. Reg., III[te] beil, p. 16, 1886; not of the Museum Calonnianum, p. 26, 1797, not *Trochula* Schleuter, Verz., p. 7, 1838.

This genus has had a number of names applied to it, among which one is proposed by Westerlund as taken from Da Costa (1778) but, as indicated by Sherborne in the *Index Animalium*, Da Costa merely quoted part of a polynomial phrase (*Trochilus terrestris mortoni*) in his synonymy, from Morton's Northamptonshire (London, 1712), and did not use the word *Trochilus* in a generic sense. Moreover, if he had, *Trochilus* had previously been used by Linné for a genus of birds. There seems at present no reason to doubt that the first valid name for the genus is *Euconulus* Reinhardt, while the typical species, as will be evident from the following synonymy, is *E. trochiformis* (Montagu).

Euconulus trochiformis (Montagu).

? *Helix fulva, ex parte* MÜLLER, Verm. Terr. et Fluv., II, p. 57, 1774; Zool. Dan. Prodr., p. 240, No. 2905, 1776.
Trochus terrestris (LISTER) DA COSTA, Brit. Conch., p. 35, 1778; not of Pennant, 1767.
Helix trochiformis MONTAGU, Test. Brit., II, p. 427, pl. II, fig. 9, 1803. Not of Férussac, 1819.
Helix trochulus MONTAGU, *op. cit.*, in syn., not of Müller, 1774. — DILLWYN, Descr. Cat. Rec. Sh., II, 916, 1817.
Helix fulva DRAPARNAUD, Hist. Nat. des Moll. Ter. et Fluv. France, p. 81, pl. VII, figs. 12, 13, 1805. — RÖSSMÄSSLER, Icon., II, pt. II, p. 38, pl. 39, fig. 535, 1838.
Helix nitidula VON ALTEN, Syst. abh. Erd. u. Fluss-Conch., p. 53, pl. IV, fig. 8, 1812.
Helix fulva NILSSON, Hist. Moll. Suec., p. 13, 1822.
Helix trochiformis MATON and RACKETT, Linn. Trans., VIII, p. 200, 1807.— FLEMING, Edin. Encyc., VII, p. 80, 1813.—WOOD, Ind. Test., pl. 32, fig. 68, 1825.—JEFFREYS, Linn. Trans., XVI, p. 331, 1830.
Teba fulva LEACH, Syn. Brit. Moll. Proofsheets, p. 99, 1820; *fide* Rössmässler, Icon., II, p. 38, 1838.—LEACH, Syn. Brit. Moll. (ed. Gray), p. 72, 1852.
Helix trochilus FLEMING, Brit. An., p. 260, 1828.
Helix mandralisci BIVONA, Nuovo Moll. Palermo, p. 16, pl. I, fig. 6, 1839.
Helix fulva var. *mortoni* JEFFREYS, Linn. Trans., XVI, p. 332, 1830.
Conulus fulvus FITZINGER, Syst. Verz., p. 94, 1833.
Polita fulva HELD, Weichth. Bayerns, Isis, Dec., 1837, col. 916.
Helix (Petasia) trochiformis BECK, Index, p. 21, 1837.
Zonites (Conulus) fulvus MOQ. TANDON, Moll. France, p. 68, 1855.
Helix (Conulus) fulva ALBERS, Heliceen, p. 73, 1850.
Hyalina (Conulus) fulva VON MARTENS' Albers, p. 73, 1860.
Hyalinia (Petasia) fulva MÖRCH, Syn. Moll. Terr. Dan., p. 14, 1864.
Euconulus fulvus REINHARDT, Sitzb. Ges. Naturf. Freunde zu Berlin, p. 86, 1883.

Arnouldia fulva BOURGUIGNAT, Bull. Soc. Mal. de France., VII, p. 328, 1890.
Vitrea (*Conulus*) *fulva* E. A. SMITH, Journ. Conch. (Leeds), VI, No. X, p. 339, 1891.
Euconulus fulvus WOODWARD, Brit. Nonmarine Moll., p. 353, 1903.
Helix egena SAY, Journ. Acad. Nat. Sci. Phila., V, p. 120, 1825.
Hyalina (*Conulus*) *fulva* BINNEY, Land and Freshw. Sh. of N. Am. part I, p. 46, fig. 73, 1869.
Hyalinia (*Conulus*) *trochiformis* (MONTAGU) WESTERLUND, Nachr. Mal. Ges., XV, p. 173, Dec., 1883.
Trochulus trochiformis WESTERLUND, Fauna Pal. Reg., III[te] beilage, p. 16, 1886.
Conulus chersinus MORSE, Journ. Portland Soc. N. Hist., I, p. 19, figs. 44, 46, pl. II, fig. 4, pl. VII, fig. 45, 1864, not *Helix chersina* Say, 1821.
Conulus fulvus (MÜLLER), and var. *alaskensis* PILSBRY, Nautilus, XII, No. 10, pp. 115–6, 1899.
Euconulus fulvus PILSBRY, Nautilus, XIV, Nov., 1900, p. 81.

Variety *fabricii* (Beck).

Helix nitida FABRICIUS, Fauna Grönl., p. 389, 1780, not of Müller.
Helix (*Petasia*) *fabricii* BECK, Index, p. 21, 1837, nude name. — MÖLLER, Index Moll. Grœnl., p. 7, 1842.

Range. — Holarctic, and widely distributed southward.

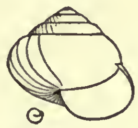


FIG. 28. *Euconulus trochiformis* (magnified).

Canada; Manitoba at Carberry, Pine Creek, Pembina, and Lake of the Woods; in Alberta at Laggan, Red Deer, Olds and McLeod; English River, Keewatin; California! Oregon! Washington! Victoria, Vancouver Island! Sitka, Alaska; Unalaska! Bering Island, Bering Sea! Petropavlovsk, Kamchatka! Pooten, Konyam and St. Lawrence Bays, eastern Siberia.

FIG. 29. *Euconulus trochiformis* var. *fabricii*, $\frac{4}{1}$ (Greenland).

Variety *fabricii* Möller. Greenland! Ungava! Labrador.

Variety *alaskensis* Pilsbry. Yukon drainage, Lake Lindeman to Point Romanof and St. Michael, Alaska; Dyea valley, Southeastern Alaska!

This familiar little shell has had various vicissitudes in nomenclature. The name *fulva* Müller, by which it is best known, was based, according to Beck, who was custodian of Müller's types, upon *Helix bidentata* Gmelin, while a shell which Müller supposed to be the young, but did not figure or fully describe, was supposed by some of the early naturalists to be our species. Another unfigured species, *Helix trochulus* Müller, was thought by Dillwyn to be identical with our *fulva*, but the measurements forbid the identification, and Pfeiffer came to the conclusion that *H. trochulus* is identical with the young tip of *Buliminus obscurus*. Fabricius supposed our shell to be identical with *Helix*

hammonis Ström (1765), but Ström's figure is widely umbilicated and so rude as to be practically unidentifiable.

The first specific name which unmistakably applies to our shell, and to it alone, is the *trochiformis* of Montagu, which it seems advisable to adopt.

Under the name *fulva* several distinct though very closely allied forms have been generally included. Reinhardt, Bourguignat and lastly Pilsbry have thrown additional light on this subject, and a number of species or marked varieties are now recognized. The *Helix chersina* of Say is a southern form, while the *H. egena* of Say is generally admitted to be a synonym of the *trochiformis*.

The *Euconulus fabricii* of Greenland seems to be merely a case of an offshoot which by isolation has been enabled to assume distinctive characters, which have hardly reached a greater than varietal rank.

Genus **Zonitoides** Lehmann.

Zonitoides nitidus Müller.

Helix nitida MÜLLER, Hist. Verm., II, p. 32, 1774.
Helix lucida DRAPARNAUD, Hist. Moll. de France, p. 103, 1805; not of the Tableau, 1801.
Hyalina nitida TRYON, Am. Journ. Conch., II, p. 250, pl. IV, fig. 24, 1866. — BINNEY, Land and Fw. Sh. N. Am., I, p. 31, figs. 35, 36, 1869.
Zonitoides nitidus PILSBRY, Class. Cat., p. 27, 1898.

Range. — Holarctic. Europe, northern United States, British America, Alaska, Japan.

Red River drift, Manitoba; Peace River, Athabaska; Fort Resolution, Great Slave Lake; Seattle, Wash.! Klukwan, Alaska (Krause).

This species has been found so widely spread that it cannot reasonably longer be regarded as merely a European emigrant.

Zonitoides arboreus Say.

Helix arboreus SAY, Nicholson's Encyl., 1st Am. edition, pl. IV, fig. 4, 1817.
Helix arborea GOULD, Inv. Mass., p. 182, fig. 110, 1841. — MORSE, Am. Nat., I, p. 542, fig. 30, 1867.
Hyalina arborea MORSE, Journ. Portland Soc. Nat. Hist., I, p. 14, fig. 28, pl. VI, fig. 29, 1864. — BINNEY, Land and Fw. Sh. N. Am., I, p. 33, figs. 38–40, 1869.
Helix breweri NEWCOMB, Proc. Cal. Acad. Sci., III, p. 118, 1864.

Range. — North America generally and Japan.

Labrador; Ontario; English River! Keewatin and Moose Factory; Carberry and Lake of the Woods, Manitoba; Laggan and Red Deer, in Alberta; Great Slave Lake! Oregon, at Weston! Vancouver Island at Victoria! Departure Bay! Nanaimo! Comox! Union Bay! etc.; in Alaska at Unalaska! Petropavlovsk, Kamchatka! Japan (Hirase).

Zonitoides randolphi Pilsbry.

Zonitoides randolphi PILSBRY, Nautilus, XII, p. 87, 1898.— RANDOLPH, *op. cit.*, p. 110, 1899.

Range. — Lake Lindeman, headwaters of the Yukon, British America.

I have not seen this species, which is less than 5 mm. in diameter. It has not been figured.

Zonitoides minusculus Binney.

Helix minuscula BINNEY, Boston Journ. Nat. Hist., III, p. 435, pl. XXII, fig. 4, 1840.— MORSE, Am. Nat., I, p. 543, fig. 35, 1867.
Pseudohyalina minuscula MORSE, Journ. Portland Soc. N. Hist., I, p. 16, fig. 34, pl. VII, fig. 35, 1864.

Range. — North America generally.

Red River of the North, Manitoba; Victoria and Departure Bay! Vancouver Island; Berg Bay, Muir Inlet! Alaska; Coal Harbor, Unga Island, Shumagins! Rooluk Island! near Unalga, Aleutians, Alaska.

Zonitoides milium Morse.

Helix milium MORSE, Proc. Boston Soc. Nat. Hist., VII, p. 28, 1859; Am. Nat., I, p. 543, fig. 36, 1867.
Striatura milium MORSE, Journ. Portland Soc. Nat. Hist., I, p. 18, figs. 41, 42, pl. VII, fig. 43, 1864.

FIG. 30. *Zonitoides milium*, from below (magnified).

Range.—Eastern United States and Canada. Manitoba (rare, Hanham).

The report of this species from Vancouver Island was probably based on the following form. *Z. minusculus* has also been wrongly identified as *Z. milium.*

Zonitoides pugetensis Dall.

Patulastra ? (*Punctum ?*) *pugetensis* DALL, Nautilus, VIII, No. 11, p. 130, Mar., 1895.
Zonitoides pugetensis PILSBRY, Nautilus, IX, p. 18, 1895.
Zonitoides (*Pseudohyalina*) *pugetensis* DALL, Proc. U. S. Nat. Mus., XXIV, p. 500, pl. XXVII, figs. 10, 12, 1902.

Range. — Puget Sound region, Oregon, California.

Seattle, Wash.! Nanaimo, Vancouver Island.

Genus **Gastrodonta** Albers.

***Gastrodonta gularis** Say?

Helix gularis J. DE C. SOWERBY, in Richardson, Fauna Bor. Am., III, p. 315, 1836 (nude name).

Range. — Lake Superior, Winnipeg, and Saskatchewan River (Sowerby).

This name is doubtless one given by Sowerby to some unknown shell, as it is as certain as almost anything can be, that *Helix gularis* Say was never collected in the region referred to.

Genus **Pristiloma** Ancey.

Pristiloma lansingi Bland.

Zonites lansingi BLAND, Ann. Lyc. Nat. Hist. N. Y., XI, p. 74, figs. 1, 2, 1875.
Microphysa lansingi BINNEY, Man. Am. Land Sh., p. 90, figs. 55, 56, 1885.
Pristiloma lansingi PILSBRY, Class. Cat., p. 29, 1898.

Range. — Oregon, Washington, British Columbia.

Astoria, Oregon! Seattle, Wash.! common at Victoria! and Nanaimo! Vancouver Island.

Pristiloma stearnsii Bland.

Zonites stearnsii BLAND, Ann. Lyc. Nat. Hist. N. Y., XI, p. 76, fig. 3, 1875, (Astoria, Oregon).
Microphysa stearnsii BINNEY, Bull. Mus. Comp. Zool., XI, No. 8, p. 147, pl. II, figs. N, O, 1883; XIII, No. 2, p. 44, 1886.
Pristiloma stearnsi BINNEY, Bull. Mus. Comp. Zool., XXII, No. 4, p. 176, 1892.

Range. — Columbia River to Dyea, Alaska.

Astoria and Portland, Oregon! Olympia, Wash.! Comox! Union Bay! and Salt Spring Island, British Columbia; Killisnoo, Portage Bay, Anuk, Dyea valley, Klehini and Klukwan, Southeastern Alaska.

Pristiloma taylori Pilsbry.

Pristiloma taylori PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1899, p. 185, pl. IX, figs. 6, 7, 8 (Nanaimo).

Range. — Oregon, Washington and British Columbia at Nanaimo, Vancouver Island.

***Pristiloma pilsbryi** Vanatta.

Pristiloma pilsbryi VANATTA, Proc. Acad. Nat. Sci. Phila., for 1899, p. 120, fig. 1 (3 views).

Range. — Portland, Oregon.

***Pristiloma idahoënse** Pilsbry.

Pristiloma idahoënse PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1902, p. 593, (Weiser Canyon).

Range. — Idaho, in Washington and Boise counties at Weiser Canyon and Big Payette Lake.

This and the preceding species will probably be found within our area when it is thoroughly explored.

Pristiloma? arctica Lehnert.

Hyalina arctica LEHNERT, Science Record, II, p. 172, June 16, 1884.
? *Conulus arcticus* DALL, in Pilsbry, Proc. Acad. Nat. Sci. Phila., for 1899, p. 187.
? *Pristiloma arctica* PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1899, p. 186, pl. IX, figs. 3, 4, 5.

Range. — Yakutat Bay, Alaska, to Point Barrow.

Point Barrow, Lat. 71° 25′ N.! Unalaska! Coal Harbor, Unga Island, Shumagins! Orca, Prince William Sound! and Yakutat Bay, Alaska!

This may prove to be a depressed *Euconulus* when the animal is anatomically examined.

The species was formerly confused with *P. stearnsii*. It occurs in the moss of the tundra near Point Barrow, where at most it can have but three months of activity out of the whole year.

Family LIMACIDÆ.

Genus Agriolimax Mörch.

FIG. 31. *Agriolimax agrestis* L.

Agriolimax agrestis Linné.

Limax agrestis LINNÉ, Syst. Nat., ed. X, p. 652, 1758. — FORBES and HANLEY, Brit. Moll., IV, p. 13, pl. DDD, fig. 3, 1853.

Range. — Both coasts of America, introduced from Europe.

Victoria, B. C.! Manitoba; Ungava!

Agriolimax hyperboreus Westerlund.

Limax hyperboreus WESTERLUND, Land och Sötv. Moll. Sibiriens, p. 21, 1876. — BINNEY, Man. Am. Landsh., p. 473, fig. 416, 1885; Bull. Mus. Comp. Zool., XIII, No. 2, p. 42, 1886; XIX, No. 4, p. 205, fig., pl. VIII, fig. F, 1890.
Limax (*Agriolimax*) *hyperboreus* DALL, Proc. U. S. Nat. Mus., for 1886, p. 202, Oct., 1886.

Range. — The Arctic and boreal regions of both hemispheres.

Bering Id.! Kamchatka! Chukchi Peninsula! Alaska at Norton Sound! Nushagak! Unalaska! Coal Harbor, Shumagins! St. Paul Island, Bering Sea! Kadiak Island! Sitka! and Cape Fox! In Vancouver Island at Comox; Seattle, Wash.; Alberta at Laggan, altitude 5,200 feet; Manitoba; Ungava, Labrador!

This little black slug is the prevalent and almost the only animal of its kind in the higher latitudes of North America. It has been referred

to *A. campestris* as a variety by some authors, but it is at least the only form of *campestris* known in the north and seems distinct enough to be recognized as a species.

Agriolimax berendti Strebel.

Limax berendti STREBEL and PFEFFER, Mex. l. u. süssw. Conch., IV, p. 22, pl. IX, figs. 10, 12; pl. XV, fig. 3, 1880.
Limax hemphilli BINNEY, 3d Suppl. Terr. Moll., V, p. 205, pl. VIII, fig. E; pl. I, fig. 13, pl. II, fig. 3, 1890; Bull. Mus. Comp. Zool., XXII, No. 4, p. 166, pl. III, fig. 1, 1892.

Range. — Guatemala to British Columbia.

Genus **Amalia** Moquin Tandon.

* **Amalia hewstoni** Cooper.

Limax (*Amalia*) *hewstoni* COOPER, Proc. Acad. Nat. Sci. Phila., for 1872, p. 145, pl. III, figs. B1–B5.
Amalia hewstoni PILSBRY, Class. Cat., p. 29, 1898.

Range. — San Diego to Seattle. San Francisco, Calif.!

This form may perhaps be an evolution from imported specimens of the European *A. gagates*. It probably extends into British Columbia.

Family ARIONIDÆ.

Genus **Prophysaon** W. G. Binney.

Prophysaon andersoni Cooper.

Arion? andersoni COOPER, Proc. Acad. Nat. Sci. Phila., for 1872, p. 148, pl. III, figs. F1–F5. — PILSBRY, *op. cit.* for 1898, p. 245, pl. X, figs. 18–22; pl. XI, figs. 28, 29; pl. XIII, figs. 59–62; pl. XVI, figs. 92–93, 1898. Not *P. andersoni*. — BINNEY, in 2d Suppl. Terr. Moll., p. 42.
Prophysaon andersoni BINNEY, 3d Suppl. Terr. Moll., V, p. 208, pl. III, fig. I, pl. VII, fig. C, pl. I, fig. 3, pl. IX, figs. I, J, 1890.
Prophysaon andersoni vars. *marmoratum* and *suffusum* COCKERELL, The Conchologist, II, pp. 72, 118.
Prophysaon hemphilli BLAND and BINNEY, Ann. Lyc. Nat. Hist. N. Y., X, p. 295, pl. XIII, excluding fig. 5.
Prophysaon pacificum et P. flavum COCKERELL, Nautilus, III, p. 111, Feb., 1890. — PILSBRY, *op. cit.*, p. 246, 1898.
Prophysaon andersoni var. *pallidum* COCKERELL, Nautilus, V, p. 31, July, 1891.

Range. — San Francisco north to Alaska and eastward to Idaho.

Variety *pallidum* Cockerell, Vancouver Island! British Columbia; Cape Fox, Alaska!

Type (*andersoni*) Victoria and Nanaimo, British Columbia.

Var. *pacificum* Cockerell, Victoria, B. C.!

I have followed Dr. Pilsbry's arrangement of the varying forms of this remarkable self-amputating slug.

* **Prophysaon foliolatum** Gould.

Arion foliolatus GOULD, Moll. U. S. Expl. Exped., p. 2, pl. I, figs. 2*a*, 2*b*, 1852: Puget Sound.
Phenacarion foliolatus COCKERELL, Nautilus, III, p. 127, Mar., 1890.
Phenacarion hemphilli W. G. BINNEY, 3d Suppl. Terr. Moll., V, p. 208, pl. VIII, fig. C, IX, fig. H; 4th Suppl., p. 183; not *Prophysaon hemphilli* Bland and Binney.
Prophysaon foliolatum (GOULD) PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1898, p. 248, pl. X, figs. 15, 16, 17; pl. XI, fig. 32; pl. XIII, figs. 55, 56, 57, 58; pl. XIV, fig. 70; pl. XV, fig. 80; pl. XVI, figs. 90, 98.

Range. — Puget Sound region.

Prophysaon humile Cockerell.

Prophysaon humile COCKERELL, Nautilus, III, p. 112, Feb., 1890.— W. G. BINNEY, 3d Suppl. Terr. Moll., V, p. 211, pl. VII, figs. E, G, L, M, 1890. PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1898, p. 251, pl. XVI, fig. 97.
Prophysaon fasciatum COCKERELL, in Binney, 3d Suppl. Terr. Moll., V, p. 209, pl. VII, fig. A, 1890.—PILSBRY, *op. cit.*, p. 251, pl. X, figs. 23–27; pl. XI, fig. 34; pl. XII, figs. 37–40; pl. XVI, figs. 91, 94–96.
Prophysaon fasciatum var. *obscurum* COCKERELL, The Conchologist, II, p. 119, Mar. 1893.

Range. — Northern Idaho to Puget Sound and northward to Alaska.

P. humile Loring, Alaska! Seattle!

P. fasciatum Old Mission, Idaho; Chehalis and Seattle, Wash.

* **Prophysaon cœruleum** Cockerell.

Prophysaon cœruleum COCKERELL, Nautilus, III, p. 112, Feb., 1890.— BINNEY, 3d Suppl. Terr. Moll., V, p. 209, pl. VII, figs. I, J, May, 1890.— PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1898, p. 253, pl. IX, figs. 7–11; pl. XI, fig. 30; pl. XIII, figs. 51–53; pl. XVI, fig. 86, Nov., 1898.
P. cœruleum var. *dubium* COCKERELL, *loc. cit.*, 1890.

Range. — Portland, Oregon; Seattle and Olympia, Wash.

Genus **Ariolimax** Mörch.

Ariolimax columbianus Gould.

Limax columbianus GOULD, Terr. Moll., II, p. 43, pl. LXVI, fig. 1, 1851; Moll. U. S. Expl. Exp., p. 3, fig. 1, *a*, *b*, 1852.
Ariolimax columbianus MÖRCH, Mal. Bl., VI, p. 110, 1859. — BINNEY, Am. Journ. Conch., I, p. 48, pl. VI, figs. 11–13, 1865; Land and Fw. Shells N. Am., I, p. 279, fig. 499, 1869; Man. Am. Landsh., p. 98, figs. 58–61, 1885. — PILSBRY, Proc. Acad. Nat. Sci. Phila. for 1896, p. 342; 1898, p. 235, pl. XV, fig. 81; pl. XIV, fig. 66; pl. XV, figs. 73, 74, 1898.

Range.— Santa Barbara, northward to Sitka, Victoria, and Nanaimo. Malcolm Island and Broughton Strait, British Columbia; SE. Alaska (to Cross Sound?) Klawak, Prince of Wales Archipelago! Sitka, Alaska! and probably north to Cross Sound and Icy Strait, or even Lituya Bay.

This is the common slug of British Columbia and Alaska, found in damp places in the wooded region. It varies from dark maculate to yellowish olive, and when full grown may reach a length of eight or nine inches, when fully extended. It is very fond of the leaves of the Alaskan skunk cabbage, a taste shared by bears and the Alaskan deer. It produces a profuse and most tenacious slime. When the Indians wish to catch the ruby-throat humming bird they gather two or three of these slugs and whip them with small bare twigs. Under this treatment slime is given off in large quantity and adheres to the twigs, which are afterward placed among the flowers visited by the hummers. If they alight on one of the twigs they cannot escape from the adhesiveness of this singular birdlime. It is said one of the ancient chiefs had a cape entirely covered with the resplendent plumage of the male ruby-throat, and which was regarded as incredibly valuable. The black spotted form seems to have been named *maculatus*, by Cockerell, and the yellow mutation *stramineus*, by Hemphill, but they occur indiscriminately in Alaska and are probably only individual color-mutations.

* **Ariolimax steindachneri** Babor.

Ariolimax steindachneri BABOR, Ann. K.K. Naturh. Hof-Museum, Wien, xv, p. 85, 1900.

Range. — Puget Sound.

I am unable to state whether this is distinct or one of the mutations of *A. columbianus*.

Genus **Hemphillia** Bland and Binney.

FIG. 32. *Hemphillia glandulosa* Binney.

* **Hemphillia glandulosa** B. and B.

Hemphillia glandulosa BLAND and BINNEY, Ann. Lyc. Nat. Hist. N. Y., x, p. 209; pl. IX, figs. 1, 3, 5, 15, 16, 17, 1872. — PILSBRY and VANATTA, Proc. Acad. Nat. Sci. Phila., for 1898, p. 233, pl. IX, figs. 1, 2; pl. XII, figs. 49, 50.

Range. — Astoria, Oregon, and Puget Sound region.

* **Hemphillia camelus** Pilsbry and Vanatta.

Hemphillia camelus PILSBRY and VANATTA, Nautilus, XI, p. 44, Aug., 1897; Proc. Acad. Nat. Sci. Phila., for 1898, p. 234, pl. IX, figs. 3, 4; pl. XII, figs. 41, 42; pl. XVI, fig. 85.

Range. — Northern Idaho, at Old Mission. Like other species of northern Idaho this probably extends across the parallel into British America.

Family **ENDODONTIDÆ.**

Genus **Pyramidula** Fitzinger.

Subgenus **Patula** Held.

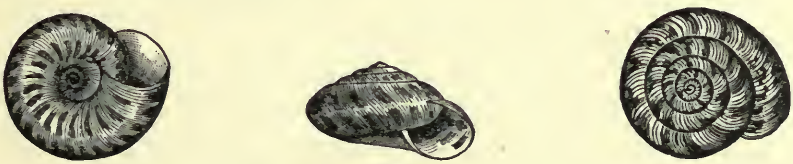
Pyramidula solitaria Say.

Helix solitaria SAY, Journ. Acad. Nat. Sci. Phila., II, p. 157, 1821. — BINNEY, Terr. Moll. U. S., I, p. 254, pl. VIII, figs. 6–10; II, p. 208, pl. XXIV, 1851.
Patula solitaria (SAY) BINNEY, Man. Am. Landsh., p. 254, figs. 263, 267, 268, 1885.
Helix limitaris DAWSON, Rep. Brit. N. Am. Boundary Survey, Geology, pp. 347–350, 1875.
Pyramidula solitaria limitaris PILSBRY, Class. Cat. Am. Landsh., p. 31, 1898.
Patula solitaria var. *occidentalis* VON MARTENS, *fide* Pilsbry, l. c., p. 31, 1898.

Range. — Arkansas north to Ohio, west to eastern Oregon, and northward in Alberta.

Var. *limitaris*, Waterton Lake, Rocky Mts. in Alberta; northern Idaho.

Var. *occidentalis*, Dalles of the Columbia near Fort Vancouver; Cœur d'Alene Mts., Idaho.



33 34 35

FIGS. 33–35. *Pyramidula alternata* Say.

***Pyramidula alternata** Say.

Helix alternata SAY, Nicholson's Encycl., 1st Am. ed., II, pl. 1, fig. 2, 1817. — BINNEY, Land and Fw. Sh. N. Am., I, p. 73, figs. 122–129, 1869.
Anguispira alternata MORSE, Journ. Portland Soc. N. Hist., I, p. 11, fig. 15, pl. IV, fig. 16, 1864.
Helix dubia SHEPARD, Trans. Lit. Sci. Soc. Quebec, I, p. 194, 1829.

Range. — Eastern North America as far north as Nova Scotia, Lower Canada, and the international boundary.

Lake of the Woods! (Kennicott); Canso, Nova Scotia (*fide* Binney).

Binney (*op. cit.*, pp. 74, 76) gives the northeastern range of this species as Labrador, but Canso, where his specimens were obtained, is

in Nova Scotia, not Labrador. I have no authentic record of this species north of Lake of the Woods.

Subgenus **Gonyodiscus** Fitzinger.

Pyramidula striatella Anthony.

Helix striatella ANTHONY, Boston Journ. Nat. Hist., III, p. 278, pl. III, fig. 2, 1840. — GOULD, Inv. Mass., p. 178, fig. 112, 1841.
Patula striatella BINNEY, Man. Am. Land Shells, p. 69, figs. 28, 29, 1885.
Pyramidula (*Gonyodiscus*) *striatella* PILSBRY, Class. Cat. Am. Landsh., p. 32, 1898.

Range. — Kansas northward to Great Slave Lake and from New England to the Sierra Nevada, and south to Arizona.

Woods of the Winnipeg basin, Turtle Mt., Lake of the Woods! English River! Manitoba; Moose Factory! James Bay; Great Slave Lake at Fort Resolution! in Alberta at Laggan, Red Deer, Olds, and McLeod, west to the Selkirk Range.

It is difficult to distinguish immature specimens of this species from *P. cronkhitei* Newc., but when full grown perfect specimens are compared it is seen that *striatella* is a smaller shell with a proportionately larger umbilicus, it is of a richer brown color, more regularly and elegantly ribbed and more polished or glistening on the surface. The animal of *striatella* shows no red maculations through the translucent shell when living, such as are seen in *P. ruderata*.

Pyramidula cronkhitei Newcomb.

Helix cronkhitei NEWCOMB, Proc. Cal. Acad. Sci., III, p. 180, 1865.
Patula cronkhitei TRYON, Am. Journ. Conch., II, p. 263, 1866. — BINNEY, Man. Am. Landsh., p. 70, fig. 30, 1885.
Pyramidula striatella cronkhitei PILSBRY, Class. Cat. Am. Landsh., p. 32, 1898.
Patula pauper BINNEY (*ex parte*), Man. Am. Landsh., p. 187, 1885.

Range. — Nevada and California in the wooded mountain region to 6,000 feet; Klamath Lake and valley, Oregon, and northward.

British Columbia at Nanaimo; Lake Lindeman, Yukon Territory; in Alaska at Sitka! Chilkat Inlet! and valley; Chilkoot Inlet! and valley! shores of Yakutat Bay! English Bay (Merriam)! and St. Paul, Kadiak Island! Popof and Unga Islands! Shumagins; Chika Rocks! and Akutan Island! Akutan Pass; Unalaska (Dall, Elliott, Kincaid, Turner)!

Mr. Binney observes that this species is larger, of a lighter color, is more coarsely (and I may add more irregularly) striated than *P. striatella*. It also has when full grown a larger shell and relatively smaller and deeper umbilicus. I am obliged to confess that I am not able to distinguish shells long dead from those of *P. ruderata*, which

replaces this species on Bering Island and in Kamchatka. But when the animals are living *P. ruderata* shows through the translucent shell deep red or red-brown radiating maculations, which are situated on the mantle. After the shells have been dead some time this maculation disappears. Now the living *P. cronkhitei* do not show any such color-markings. The presence of the latter led Morelet to name an immature *ruderata*, *Helix floccata*. The shell figured by von Martens in the Conchologische Mittheilungen under the name of *floccata* does not agree with Morelet's original diagnosis, and was not found by me during much energetic collecting at his locality, Petropavlovsk, Kamchatka, in 1865. If, as stated by von Martens, it really comes from the original lot collected by Morelet it is evident that his diagnosis (which calls for a shell with an angular periphery like young *ruderata*) was founded on a mixture, of which young *ruderata* probably formed a part. But I am inclined to believe that von Martens was misled in regarding the shell he figured to be a native of Kamchatka.

Pyramidula pauper Gould was described from the same locality as Morelet's *floccata*, and is undoubtedly the same as the shell I have called *ruderata*, following Morelet, Middendorff and others. But the *P. cronkhitei* from Unalaska and other places in Alaska which has been called *pauper* by Dr. Cooper and others, is our American shell. Mr. Binney thought it different from *P. cronkhitei*, but after much study and consideration I cannot confirm this opinion.

Subgenus **Planogyra** Morse.

***Pyramidula asteriscus** Morse.

Helix asteriscus MORSE, Proc. Boston Soc. Nat. Hist., VI, p. 128, 1857; Am. Nat., I, p. 546, fig. 43, 1867.
Planogyra asteriscus MORSE, Journ. Portland Soc. Nat. Hist., I, p. 24, figs. 51, 52; pl. II, fig. 5; pl. VIII, fig. 53, 1864.
Patula asteriscus BINNEY, Man. Am. Landsh., p. 186, figs. 185, 186, 1885.
Pyramidula (*Planogyra*) *asteriscus* PILSBRY, Class. Cat. Am. Landsh., p. 33, 1898.

Range.—Maine; Provinces of Quebec and Ontario, Canada; Vancouver Island? Tacoma, Wash.?

This species has been reported from British Columbia and Washington, but it seems the identification is somewhat doubtful, and the shells were probably *Punctum clappi* Pilsbry.

Genus **Oreohelix** Pilsbry.

Oreohelix strigosa Gould.

Helix strigosa GOULD, Proc. Boston Soc. Nat. Hist., II, p. 166, 1846: Moll. U. S. Expl. Exped., p. 36, fig. 41, 1852.— BINNEY, L. and Fw. Sh. N. Am., I, p. 72, 1869.

Helix cooperi BINNEY, Proc. Acad. Nat. Sci. Phila., for 1858, p. 118; Land and Fw. Sh. N. Am., I, p. 78, figs. 132–137, 1869.
Helix haydeni GABB, Am. Journ. Conch., V, p. 24, pl. VIII, fig. 1, 1869.
Anguispira bruneri ANCEY, La Nature, III, p. 468, Sept., 1881.
Oreohelix strigosa PILSBRY, Nautilus, XVII, No. 11, p. 131, footnote, 1904.

Range. — Type at Spokane, Wash., also in the Rocky Mountain region from northern Mexico to and somewhat beyond the 49th parallel westward from the Lake of the Woods.

Var. *cooperi*, Lake of the Woods, and westward to the Rockies near the 49th parallel.

Var. *stantoni* Dall (1905). Thirty-three miles southeast of Medicine Hat, Assiniboia, near top of Cypress Hills, altitude 4,700 feet; latitude about 49° 30′, west longitude 110° 10′.

The variety *stantoni* is dwarfed, measuring in maximum diameter 10.0, minimum 8.5, and height 8.0 mm., with about five whorls, a peripheral brown band with a narrower one above and sometimes others on the base, the remainder ashy, rudely incrementally striate, with rounded periphery and deep narrow (1 mm.) umbilicus. It is very similar to some varieties of the European *H. virgata* Da Costa. Eight specimens were collected by Dr. T. W. Stanton in 1903.

A large number of names, varietal and other, have been given to the mutations of this species, which barely enters the region covered by this memoir, at its southern border near the Rocky Mountains. The group is viviparous, and the young attain a large size before extrusion.

Genus **Helicodiscus** Morse.

Helicodiscus lineatus Say.

Helix lineata SAY, Journ. Acad. Nat. Sci. Phila., I, p. 18, 1819.—GOULD, Inv. Mass., p. 179, fig. 103, 1841.—MORSE, Am. Nat., I, p. 546, fig. 44, 1867.
Planorbis parallelus SAY, Proc. Acad. Nat. Sci. Phila., II, p. 164, 1821.
Helicodiscus lineatus MORSE, Journ. Portland Soc. Nat. Hist., I, p. 25, figs. 61, 62, pl. II, fig. 3; pl. VII, fig. 63, 1864.— BINNEY, Man. Am. Landsh., p. 75, figs. 34–37 A, 1885.

Range. — New Mexico to Manitoba, New England to California. Reported as rare in Manitoba by Hanham.

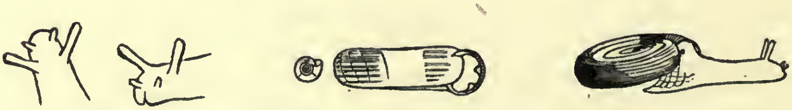


FIG. 36. *Helicodiscus lineatus*, shell and animal (magnified).

Genus **Punctum** Morse.

Punctum pygmæum Draparnaud.

Helix pygmæa DRAPARNAUD, Hist. Moll., p 114, pl. VIII, figs. 8, 9, 10, 1805.
Helix minutissima LEA, Trans. Am. Phil. Soc., IX, p. 17; Proc., II, p. 82, 1841. — BINNEY, Terr. Moll., IV, p. 100, pl. LXXVII, figs. 6, 7, 1859. — MORSE, Am. Nat., I, p. 546, fig. 46, 1867.
Punctum minutissimum MORSE, Journ. Portland Soc. Nat. Hist., I, p. 27, figs. 69, 70, pl. VIII, fig. 71, 1864.
Microphysa pygmæa BINNEY, Man. Am. Landsh., p. 71, figs. 31–33, 1885.
Punctum pygmæum PILSBRY, Class. Cat. Am. Landsh , p. 33, 1898.

Range. — United States generally; Quebec; Manitoba; Victoria, Vancouver Island. Europe.

***Punctum randolphi** Dall.

Pyramidula? randolphi DALL, Nautilus, VIII, p. 130, Mar., 1895.
Punctum randolphi PILSBRY, Nautilus, IX, p. 18, June, 1895. — DALL, Proc. U. S. Nat. Mus., XXIV, p. 500, pl. XXVII, figs. 7, 8, 9, 1902.

Range. — Seattle, Wash.

Probably exists throughout the Puget Sound region and adjacent British Columbia.

Punctum clappi Pilsbry.

Punctum clappi PILSBRY, Nautilus, XI, p. 133, Apr., 1898; Class. Cat. Am. Landsh., p. 33, 1898.

Range. — Oregon, Washington, Vancouver Island.

Salem, Wash.; Tacoma, Wash.; Seattle, Wash.; Nanaimo and Comox, Vancouver Island.

This is probably the shell which has been reported as *P. asteriscus* Morse, from Vancouver Island and Tacoma. It has not been figured.

Punctum conspectum Bland.

Helix conspecta BLAND, Ann. N. Y. Lyc. Nat. Hist., VII, p. 163, fig. 7, 1865.
Zonites conspectus BINNEY, Terr. Moll., V, p. 121, 1873; Man. Am. Landsh., p. 86, fig. 51, 1885.
Punctum conspectum PILSBRY, Nautilus, XI, p. 133, Apr., 1898; Class. Cat. Am. Landsh., p. 32, 1898.

Range. — West America from middle California northward, and east to the west slope of the Rocky Mountains. Kamchatka.

California! Oregon; Washington; Puget Sound region generally; Victoria, British Columbia! Departure Bay, Vancouver Island! Sitka! Chilkoot Inlet and valley; Chilkat Inlet and valley; Coal Harbor! Unga Island, Shumagins; Unalaska! Alaska. Petropavlovsk! Kamchatka (Dall).

The most common of the minute species in Alaska; often found in numbers under bits of cast-off leather and chips near the tops of beaches. The Kamchatkan specimens are beyond suspicion.

Genus **Sphyradium** Charpentier.

Sphyradium edentulum Draparnaud.

Pupa edentula DRAPARNAUD, Hist. Moll., p. 59, pl. III, figs. 28, 29, 1805.
Pupa simplex GOULD, Boston Journ. Nat. Hist., III, p. 403, pl. III, fig. 21, 1840; Inv. Mass., p. 190, fig. 121, 1841.
Vertigo simplex STIMPSON, Shells of N. Engl., p. 53, 1854. — MORSE, Am. Nat., I, p. 670, figs. 67, 68, 1868. —BINNEY, Man. Am. Landsh., p. 191, fig. 195, 1885.
Pupa alticola INGERSOLL, Bull. U. S. Geol. Geogr. Survey of the Terr., No. 2, p. 128, 1875; ed. II, p. 391, fig., 1876. — BINNEY, Man. Am. Landsh., p. 174, fig. 166, 1885.
Pupa columella "BENSON," var. *gredleri* CLESSIN, from Alaska, is probably *S. edentulum.*

Range.— Northern Europe, Asia and America.

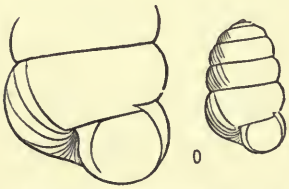


FIG. 37. *Sphyradium edentulum* (magnified).

Canada; heights of 8,000 to 9,000 feet in the Rocky Mountains, Colorado! Ungava Bay, Labrador! Laggan, Alberta; Vancouver Island at Comox, Nanaimo and Victoria; Kukak Bay, Peninsula of Alaska! Popof Island! Shumagin Islands; Rooluk Island near Unalga Pass, Aleutians! Port Clarence, Alaska! Petropavlovsk! Kamchatka (Dall).

This species has a wide distribution and considerable synonymy.

UNIDENTIFIED SPECIES.

The following *Helicidæ* are *incertæ sedis.*

Helix rudis J. de C. Sowerby in Richardson, Fauna Bor. Am., III, app., p. 315, 1836. Nude name.

" Lake Superior, Winnipeg and Saskatchewan River."

Helix attenuata J. de C. Sowerby, *op. cit.*, p. 315, 1836. Nude name.

" Lake Superior, Winnipeg, and Saskatchewan River."

Helix belcheri Pfeiffer, P. Z. S. London, for 1845, p. 128; Mon. Helic. Viv., I, p. 104; Reeve, Conch. Icon., Mon. *Helix*, pl. 190, fig. 1328.

This species, supposed to have been collected by Capt. Belcher, during his voyage to the Northwest Coast of America, has not been recognized from that quarter since; and probably, like many other

species brought home by Belcher from time to time, had got wrongly labelled.

Family SUCCINEIDÆ.

Genus Succinea Draparnaud.

Succinea DRAPARNAUD, Tabl. Moll., pp. 32, 55, 1801; Hist. des Moll. Terr., pp. 24, 29, 58, 1805. *Helix putris* Linné and *S. oblonga* Drap.; Blainville, Man., I, p. 455, 1825.
< *Amphibulima* LAMARCK, Ann. du Museum, VI, p. 304, 1805; 1st sp. *A. cuculata* Lam. = *patula* Brug. Froriep, Lam. Syst. Conch., p. 19, 1807.
< *Amphibulimus* MONTFORT, Conch. Syst., II, p. 90, 1810.
Lucena OKEN, Lehrb. d. Naturg., III, pp. x, 311, 312, 1815; *Succinea putris* (L.) Draparnaud.—HARTMANN, in Sturm, Fauna Deutschl., VI, pp. 27, 40, 54, 1821, *L. pulchella* Hartmann, sole ex. Not of Hartmann Neue Alpina, I, p. 208.—MÖRCH, Vidensk. Medd., p. 296, 1864.
Amphibulina HARTMANN, in Sturm, Fauna Deutschl., VI, pp. 42, 55, 1821; 1st sp. *Helix putris* L.
Amphibina HARTMANN, Neue Alpina, I, p. 208, 1821.—MÖRCH, Syn. Moll. Dan., p. 33, 1864; Vidensk. Meddel. Kjob., p. 295, 1864; 1st sp. *S. pfeifferi* Rössm.
< *Cochlohydra* FÉRUSSAC, Tabl. Syst., pp. XXXII, 26, 1821.
Succinia GRAY, in Turton, Man., 2nd ed., p. 110, 1840.
Tapada STUDER, Syst. Verz., p. 11, 1820.
Succinæa DESHAYES, Encyc. Méth., II, p. 18, 1830, *passim*.
> *Helisiga* LESSON, Voy. Coquille, p. 316, 1829, *H. sanctæhelenæ* Lesson, H. and A. ADAMS, Gen. Rec. Moll., II, p. 130, 1855.
> *Helisigna* MRS. GRAY, Fig. Moll. An., IV, pp. 55, 113, 1859.
Neritostoma MÖRCH, Vidensk. Meddel. Kjob., for 1863, p. 294, 1864, 1st sp. *S. putris* L.
Tapada ALBERS, Heliceen, p. 55, 1850.—PFEIFFER, Mon. Hel. Viv., IV, pp. 803, 808, 1859.
> *Brachyspira* PFEIFFER, Mon. Hel. Viv., IV, pp. 803, 804, 1859. Not of Ehrenberg, 1858.
< *Truella* PEASE, P. Z. S., 1871, pp. 459, 472; type *T. elongata* Pease.
Neritostoma WESTERLUND, Fauna d. Pal. Reg., II, V, pp. 1, 2, 1885; *S. putris* L.
Oxyloma WESTERLUND, *op. cit.*, pp. 1, 7, 1885; *S. dunkeri* (Zelebor).
Amphibina WESTERLUND, *op. cit.*, pp. 1, 8, 1st sp. *S. elegans* Risso.
Lucena WESTERLUND, *op. cit.*, pp. 1, 14, 1st sp. *S. oblonga* Draparnaud.

This genus has been divided into sections on the basis of the denticulation of the jaw, as follows:

Jaw without denticulations. *Oxyloma* (*hungarica*).
Jaw with a single median denticle. *Amphibina* (*pfeifferi*).
Jaw with a minute median denticle. *Lucena* (*oblonga*).
Jaw with three denticles *Neritostoma*. = *Succinea* s. s.

According to this scheme *S. avara* is an *Amphibina*, *S. totteniana* a typical *Succinea*, while *S. ovalis* (Say) Morse has seven denticles and is unprovided for. The differences among the few species which

have been examined are so great that it is probably better to await a more thorough knowledge of all the species, in the light of which we can judge better whether this character has any systematic value or not. Our American species resemble one another so closely that it seems hardly likely that there are any fundamental differences between them.

Succinea oregonensis Lea.

Succinea oregonensis LEA, Proc. Am. Phil. Soc., p. 32, 1841; Trans. Am. Phil. Soc., IX, p. 5, 1844. — BINNEY, Terr. Moll., II, p. 77, pl. LXVII, fig. 2, 1851. — TRYON, Am. Journ. Conch., II, p. 235, pl. (II) XVII, fig. 18, 1866. — BINNEY, Land and Fw. Sh. N. Am., I, p. 270, fig. 485, 1869.

Range. — California (to 6,500 feet alt.), Oregon, Washington, and British Columbia.

Victoria, B. C.! Wallawalla, Wash.!

This species on the Pacific Coast takes the place in the fauna occupied in the East by *S. avara* Say, which it much resembles. The *S.* '*oregonensis*' reported from Winnipeg by Hanham was probably a variety of *avara*. The surface has a silky unpolished appearance, from the very fine close wrinkles with which it is covered, and which are characteristic.

Succinea retusa Lea.

Succinea retusa LEA, Trans. Am. Phil. Soc., V, p. 117, pl. XIX, fig. 86, 1837. — W. G. BINNEY, Land and Fw. Sh. N. Am., I, p. 256, fig. 454, 1869.
Succinea ovalis GOULD, Inv. Mass., p. 194, fig. 125, 1841, not of Say, 1817.
Succinea haydeni var. *minor* W. G. BINNEY, Land and Fw. Sh. N. Am., I, p. 256, 1869. — TRYON, Am. Journ. Conch., II, p. 236, 1866.
Succinea decampi TRYON, Am. Journ. Conch., II, p. 237, pl. XVII, fig. 23, 1869. — BINNEY, *l. c.*, p. 257.

FIG. 38. *Succinea retusa* Lea.

Range. — Northern United States, from Kentucky northward to Canada and British America.

In Manitoba at Carberry, Lake of the Woods and Pembina Mountain; in Alberta at Laggan and Red Deer. Ungava, Labrador! James Bay at Moose Factory! Lower Saskatchewan near Lake Winnipeg! Norway House; York Factory; Fort Resolution, Great Slave Lake! Yukon River near old Fort Yukon, Alaska! Stewart River, Yukon district! Dall River, north of the Yukon! Duncan Bay, Discovery Passage, British Columbia.

A widespread and abundant species identified by comparison of the typical specimens or cotypes furnished by the author to the National Museum.

Succinea hawkinsi Baird.

Succinea hawkinsi BAIRD, Proc. Zool. Soc. London, p. 68, 1863. — BINNEY, Land and Fw. Sh. N. Am., I, p. 268, fig. 481, 1869.

Range. — British Columbia and eastward to Manitoba.

Lake Osoyoos, B. C.; Sitka, Alaska! Carberry, Manitoba! not common.

A large species with a produced oblique aperture and acute spire. Quite close to *S. sillimani* Bland.

Succinea avara Say.

Succinea avara SAY, Rep. Long's Exped., II, p. 260, pl. XV, fig. 6, 1824.
Succinea vermeta SAY, New Harmony Diss., II, No. 15, 1829. — TRYON, Am. Journ. Conch., II, p. 233, pl. (II) XVII, fig. 10, 1866.
Succinea wardiana LEA, Proc. Am. Phil. Soc., II, p. 31, 1841; Trans. Am. Phil. Soc., IX, p. 3, 1844. — TRYON, Am. Journ. Conch., II, p. 233, pl. (II) XVII, fig. 12, 1866.
Succinea avara BINNEY, Land and Fw. Sh. N. Am., I, p. 262, fig. 468, 1869.

FIG. 39. *Succinea avara* Say.

Range. — North America east of the Rocky Mountains from Texas to N. Lat. 62°.[1]

Lac des Mille Lacs to Lake of the Woods; lower Saskatchewan near Lake Winnipeg! Two Creeks, Manitoba; Laggan, Red Deer, Olds, and McLeod, Alberta; Fort Simpson, Mackenzie River in N. Lat. 62°!

Succinea grönlandica Beck.

Succinea grönlandica BECK, Index, p. 99, 1837; nude name. — MÖLLER, Ind. Moll. Grönl., p. 4, 1842. — MÖRCH, Am. Journ. Conch., IV, p. 31, pl. III, fig. 10, 1868. — BINNEY, Land and Fw. Sh. N. Am., I, p. 265, fig. 474, 1869. — POSSELT, Consp. Faunæ Gronl., p. 263, 1898.

Range. — Iceland and Greenland.

This species is rather close to *retusa* Lea but seems sufficiently distinct to be retained.

Succinea grosvenori Lea.

Succinea grosvenori LEA, Proc. Acad. Nat. Sci. Phila., for 1864, p. 109; Journ. Acad. Nat. Sci. Phila., n. s., VI, p. 179, pl. XXIV, fig. 108, 1866. — BINNEY, Land and Fw. Sh. N. Am., I, p. 260, fig. 462, 1869.

FIG. 40. *Succinea grosvenori* Lea.

Range. — North America, east of the Rocky Mts. from Louisiana to British America but not far east of the Mississippi.

Wood Mt., Manitoba; Egg Lake and Red Deer, in Alberta; upper Mackenzie River at Fort Simpson!

[1] *Succinea verrilli* Bland (1865, Binney, L. and Fw. Sh. N. Am., I, p. 264, fig. 472) is probably either the young or a dwarf form of this species. It is from Anticosti Id.

The distribution indicated by the literature is rather odd for a shell ranging so far south, but there is no way of clearing up the doubt at present.

Succinea rusticana Gould.

Succinea rusticana GOULD, Proc. Bost. Soc. N. Hist., II, p. 187, 1846; Moll. U. S. Expl. Exp., p. 28, fig. 29, 1852.— TRYON, Am. Journ. Conch., II, p. 236, pl. (II) XVII, fig. 19, 1866.— BINNEY, Land and Fw. Sh. N. Am., I, p. 269, fig. 483, 1869.

Range. — Tulare valley, Calif., northward to British Columbia; the variety *alaskana* to Alaska.

Comox, Vancouver Island, B. C.! Sumas Prairie, Fraser River valley, B. C.!

Variety *alaskana* Dall, nov. Flats near St. Michael, Alaska! Point Romanof! Unalaska! St. Paul, Kadiak Id.!

The Alaskan form is polished, of an olive greenish tinge, with rather inconspicuous lines of growth; with 3 tumid whorls, the general form of *rusticana* as figured by Binney, but shorter and more tumid; length 10, max. diam. 8, length of aperture 6.5 mm. This may prove, with more material, to be a distinct species.

Succinea nuttalliana Lea.

Succinea nuttalliana LEA, Proc. Am. Phil. Soc., II, p. 32, 1841. — BINNEY, Terr. Moll., II, p. 81, pl. LXVII, *a*, fig. 4, 1851.—W. G. BINNEY, Land and Fw. Sh. N. Am., I, p. 269, fig. 484, 1869.

Range. — Oregon, California, Washington and British Columbia. Victoria, Vancouver Island, B. C.

This species was also reported by Randolph from the Lewes River, Yukon Territory, but in this case the shell was probably the quite similar *S. retusa* Lea.

Succinea obliqua Say.

Succinea obliqua SAY, Rep. Long's Exp., II, p. 260, pl. XV, fig. 7, 1824. — BINNEY, Land and Fw. Sh. N. Am., I, p. 265, fig. 475, 1869.

? *Succinea ovalis* SAY, Journ. Acad. Nat. Sci. Phila., I, p. 15, 1817. Not *S. ovalis* Gould.

Succinea campestris GOULD, Inv. Mass., p. 195, fig. 126, 1841. — DE KAY, Nat. Hist. N. Y., Moll., p. 53, pl. IV, fig. 54, 1843.

Succinea greeri TRYON, Am. Journ. Conch., II, p. 232, pl. (II) XVII, fig. 8, 1866.

FIG. 41. *Succinea obliqua.*

Range. — From Louisiana to Hudson Bay and eastward to New England and Gaspé, but not west of the Mississippi Valley.

Lac des Mille Lacs to Lake of the Woods! Halifax, N. S.; Dufferin, Manitoba; Lake Winnipeg! Moose Factory, James Bay; Peace River, Athabaska! Great Slave Lake at Fort Resolution! Balæna Bay, Newfoundland!

If the identification with Say's unfigured *ovalis* were beyond dispute, the latter name is prior and would have to be adopted.

Succinea chrysis Westerlund.

Succinea chrysis WESTERLUND, Nachrbl. d. D. Mal. Ges., 1883, p. 51; Vega Expd. Vetensk. Iakttag., IV, p. 198, pl. III, fig. 10, 1885.
Succinea annexa WESTERLUND, Vega Expd., p. 199, pl. III, fig. 11, 1885.
Succinea chrysis var. *aurelia* VON MARTENS, Conch. Mitth., II, p. 184, pl. XXXIII, figs. 21–22, 1885.
Succinea lineata W. G. BINNEY, Man. Am. Landsh., app., p. 473, fig. 515, 1885, not *S. lineata* W. G. B., 1857.

Range. — Boreal America from Greenland to Bering Strait, and on the opposite shore of the Strait.

Greenland (Posselt); Fort Simpson, Mackenzie River; watershed of the Yukon, near Dawson, Yukon Territory! 30 miles below the Tanana River mouth on the Yukon, Alaska! the Koyukuk River, north of the Yukon! Nulato! Andreafski! and the Yukon delta! Point Romanof! shores of Norton Sound at Egg Island! Besboro Island! Cape Denbigh! Norton Bay! Golofnin Bay! Port Clarence! Konyam Bay on the Asiatic shore of Bering Strait; St. Michael! St. Mathew! St. Paul! and St. George! Islands, Bering Sea; north end of Nunivak Island! the Aleutian chain! Unalaska! Kadiak Island! Sitka! At Chilkat Inlet, Alaska, Krause obtained the variety *aurelia* von Martens.

This is the commonest and largest land shell of the boreal American region, passing through many mutations, but easily recognizable in all of them; often with a rich coloration varying from olive brown to orange and usually lineated with more opaque lighter axial streaks. I do not regard it as identical with the *S. lineata* of W. G. Binney, though the species have some characters in common.

Family LYMNÆIDÆ.

Genus **Lymnæa** Lamarck.

Limnea cochlea LINNÉ, Fauna Svecica, ed. I, pp. 374, 376, 1746 (not binomial).
Vesica (*ex parte*) ANONYMOUS, Mus. Calon., p. 58, 1797; *Helix stagnalis* (and *amarula*) Linné.
Helix (sp.) LINNÉ, Gmelin, Bolten in Mus. Bolt., p. 109, 1798.

Lymnæa Lamarck, Prodr. Nouv. Clas. Coq., p. 75, 1799; Syst. des An. s. Vert., p. 91, 1801, *Helix stagnalis* Linné.

Limneus Draparnaud, Tableau, pp. 30, 47, 1801, no type cited; Hist., pp. 25, 28, 48, 1805.—Gosse, Nat. Hist. Moll., p. 86, 1854.—Turton, Man., p. 127, 1831, type *L. stagnalis* L.

> *Galba* Schrank, Fauna Boica, III, pt. 2, pp. 262, 285, 1803; sole ex. *L. truncatula* Müller.

Lymnæa Roissy, Hist. Nat. Moll., V, p. 345, 1805.—Lamarck, Encycl. Méth., pl. 459, 1816.—Schumacher, Essai, p. 199, 1817.—Lamarck, An. s. Vert., VI, 2, p. 157, 1822.

Lymnæus Cuvier, Regne An., II, p. 412, 1817.

Lymnus Montfort, Conch. Syst., II, p. 262, 1810, *L. stagnalis* L.

Lymnea Risso, Hist. Nat. Eur. Mér., IV, p. 94, 1826; 1st sp. *L. pereger* (Müller). Not *Lymnea* Rafinesque, *Pisces*, 1815.

> *Radix* Montfort, Conch. Syst., II, p. 266, 1810. *Helix auricularia* Linné, sole ex.—Mörch, Vidensk. Meddel. Kjöb., p. 302, 1864.

Limnea Fleming, Hist. Brit. An., p. 273, 1828.

Limnæa Desmarest, Rapp., Soc. Philom. Paris, 1812.—Blainville, Malac, I, p. 448, 1825.—Beck, Index, p. 110, 1838.—Moquin Tandon, Hist., Nat. Moll. France, II, p. 458, 1855.

Lymneus Brard, Hist. des Coq. Terr. et Fluv. Paris, p. 133, pl. 5, 1815.—Say, Journ. Acad. Nat. Sci. Phila., II, p. 167, 1821.

> *Lymnula* Rafinesque, Journ. de Phys., LXXXVIII, p. 423, 1819; = *Lymnea* of Authors, *fide* Rafinesque, l. c.

> *Omphiscola* Rafinesque, *op. cit.*, p. 423, 1819. No species cited, but the only Ohio shell corresponding even moderately to the diagnosis is *L. reflexa* Say.

> *Gulnaria* Leach, Proofsheets, pp. 146, 148, 1819; *fide* Turton, Man., p. 117, 1831.—Gray's Turton, p. 232, 1840.—Gray, P. Z. S., 1847, p. 180; type *L. auricularia* (Linné).

Stagnicola Leach, Proofsheets, pp. 141, 145, 1819.—Jeffreys, Linn. Trans. XVI, II, p. 376, May 29, 1830, *L. palustris* Müller.—Turton, Man., pp. 121–124, Oct., 1831.—Gray's Turton, pp. 237–242, 1840.—Gray, P. Z. S., 1847, p. 180; no type cited.—Leach, Synops. Moll. Gt. Brit., p. 101, 1852, 1st sp. *L. glaber* (Müller). Not *Stagnicola* Brehm, *Aves*, Dec., 1830.

Auricularia Fabricius, Fortegnelse, p. 94, 1823 (nude name), not of Blainville, 1816.

> *Omphiscola* Beck, Index, p. 110, 1838, *L. glabra* (Müller).—H. and A. Adams, Gen. Rec. Moll., II, p. 255, 1855; not *Omphiscola* Raf., 1819.

> *Limnophysa* Fitzinger, Syst. Verz., p. 112, 1833; type *L. palustris* (Müller).—Beck, Index, p. 110, 1838.—Mörch, Vidensk. Medd., p. 298, 1864.

> *Leptolimnea* Swainson, Malac., p. 338, 1840; *L. elongata* Sowerby, = *L. glaber* (Müller).—Mörch, Vidensk. Meddel. Kjöb., p. 298, 1864.

Adelina Cantraine, Mal. Méd., I, p. 155, 1841; type *A. elegans* Cantraine, not *Adelina* Chevrolat, Coleopt., 1833.

Leachia Jeffreys, Linn. Trans., XVI, III, p. 519, 1833, not of Risso, 1829, or Lesueur, 1821, *L. stagnalis* (Linné).

> *Bulimnea* Haldeman, Mon. Limn., part 3, p. 6, July, 1841; type *Limnea megasoma* (Say) Haldeman. Not of H. and A. Adams.

> *Acella* Haldeman, Mon. Limn., part 3, p. 6, July, 1841; type *Limnea gracilis* (Say) Haldeman.

> *Pleurolimnæa* Meek, Checkl. N. Am. Fos. Eocene, pp. 9, 34, 1866; Rep. Inv. Foss. Upper Missouri, p. 533, 1876; type *P. tenuicostata* Meek and Hayden (Eocene).

> *Polyrhytis* MEEK, Rep. Inv. Fos. Upper Missouri, p. 532, 1876; type *Limnæa kingi* Meek (Pliocene).
> *Omphiscola* MEEK, Rep. Inv. Fos. Upper Missouri, p. 533, 1876; type *Limnæa glabra* (Müller); not of Rafinesque.
Omphalia "RAF.," Meek, *op. cit.*, p. 532, in syn.; *err. pro Omphiscola* Rafinesque.
? *Erinna* H. and A. ADAMS, Gen. Rec. Moll., II, p. 644, 1858; type *E. newcombi* Adams.
> *Neritostoma* H. and A. ADAMS, Gen. Rec. Moll., II, p. 253, 1855, 1st sp. *L. auricularia* (Linné). Not of Mörch, 1864.
? *Velutinopsis* SANDBERGER, Land u. süssw. Conch. d. Vorwelt, p. 700, 1875, type *Limnæa velutina* Desh. (Lower Pliocene).
> *Leptolimnæus* SANDBERGER, Land u. süssw. Conch. d. Vorwelt, p. 787, 1875; sole ex. cited *L. glaber* (Müller).
Eulimneus SANDBERGER, Land u. süssw. Conch. d. Vorwelt, pp. 787, 844, 1875; sole ex. cited *L. stagnalis* (L).
> *Fossaria* WESTERLUND, Fauna, Pal. Reg., V, p. 49, 1885; *L. truncatula* (Müller); Acta Soc. Sci. Slav. Merid., CLI, p. 118, 1902.
> *Tanousia* BOURGUIGNAT, in Servain, Hist. Mal. du Lac Balaton, 1881.[1] Type *L. zrmanjæ* Brusina; Westerlund, *op. cit.*, p. 53, 1885, p. 118, 1902.
> *Lymnophysa* (FITZINGER) HAZAY, Mal. Blatt., 2d ser., III, p. 163, 1881.
> *Limnus* DYBOWSKI, Bull. Imp. Acad. Sci. St. Petersburg, XVIII, p. 113, March, 1903, not of Agassiz, nom., 1847.
> *Omphalolimnus* DYBOWSKI, Nachrichtsbl. d. d. Mal. Ges., Sept.–Oct., 1903, XXXV, p. 143, 1903. Type *L. lagorii* Dybowski; Bull. Acad. St. Petersb., XVIII, p. 113, 1903.
> *Physastra* TAPPARONE CANEFRI, Ann. Mus. Genov., XIX, p. 245, 1883. Type *P. vestita* T.-C., *op. cit.*, p. 246. New Guinea.
> *Zagrabica* BRUSINA, Beitr. Pal. Oest.-Ung., 1884, *Z. naticoides* Brus. — WESTERLUND, Acta Acad. Sci. Slav. Merid., CLI., p. 119, 1902.
Not *Limnæa* Poli, Test. Utr. Sicil., I, p. 31, 1791, II, p. 253, 1795 (not binomial).

The genus *Lymnæa* as now understood is due to Lamarck, though several authors, including Westerlund as late as 1885, have given credit for it to Bruguière. This has probably arisen from a failure to observe the dates of the different livraisons which contained the plates of the Encyclopédie Méthodique. The plate containing the name *Lymnæa* was not issued until 1816 (though often cited as 1791), and then it was under the supervision of Lamarck, Bruguière having nothing to do with it. The name *Lymnæa* had already been used by Poli, in 1791, for the animal of various unrelated bivalves, but his ingenious quadrinominal system takes the work of Poli out of the category of those which can be cited in nomenclature, except historically.

[1] The multitude of group names used for mutations of *Lymnæa stagnalis* and other species by Servain in his 'Lake Balaton' paper, can hardly be regarded as having entered into systematic nomenclature, as they are groups of less value than species, and physiological rather than hereditary, according to Hazay.

The name *Lymnæa* has been spelled in many different ways, the most correct being *Limnæa*, but there seems to be no good reason for changing the original form, especially as no derivation was given by Lamarck. The *Helix stagnalis* of Linné, being the only species mentioned, necessarily becomes the type.

Four years after Lamarck, Schrank gave the name *Galba* to a species which was without doubt the *Buccinum truncatulum* of Müller. It has been referred to *B. palustre* Müller, but a scrutiny of the very careful description of both shell and animal reveals that it agrees with no local species of the group except a young *truncatula*. A little later Montfort separated the *L. auricularia* group under the name of *Radix*, and in 1819 Rafinesque, in a summary of the forms collected on the Ohio River, proposed *Omphiscola* for species which have the peristome reflected over the pillar and body with an umbilical chink between the reflection and the body of the shell. He cites no species, but of the Ohio species only *L. reflexa* Say can be said to agree with the diagnosis. This character is however of minor importance. Rafinesque's name has been applied to several European species but without adequate grounds, since there is no species of the *Radix* group known in any part of the Ohio system.

The name *Stagnicola* Leach was cited in synonymy by Jeffreys in 1830, in connection with *L. palustris* (Müller), thus antedating *Limnophysa* Fitzinger, 1833, based on the same type. *Stagnicola* was used by Brehm for a bird in December, 1830, but Jeffreys' paper was issued May 29. Both these names have been loosely used in the literature, but must be restricted to the typical and original forms. If the columnar species like *L. glaber* be separated in a section by themselves, *Leptolimnea* Swainson appears to be the first available name. *Erinna* Adams is a Limnæid modified for existence on rocks in rapid streams and waterfalls, the peristome being continued over the body and behind the broad excavated pillar, and the spire shortened, so that the animal may cling tightly to its situs. The descriptions of this form are rather misleading, the so-called 'lamina' being merely the pillar. The fossil *Velutinopsis* is more like *Choanomphalus* than *Lymnæa*, judging by the figures. The description of *Tanousia* reads as if it was founded upon an abnormal or monstrous specimen. The reversed physiform *Lymnæa* of the South Sea Islands will be included under *Physastra* Tapparone-Canefri; a species from Hawaii which is dextral but may be otherwise similar, has recently been shown by Pilsbry to have a somewhat different radula from the ordinary *Lymnæa* of north Europe and America.

Dybowski has recently applied the name *Omphalolimnus* to a species of *Lymnæa* from the Crimea, which in outline resembles *L. stagnalis* var. *arenaria* Colbeau, but which instead of having the axis pervious and the pillar gyrate, as in most species of this type, has the subumbilicate base and raised inner lip of the *Radix* section, to which his *L. lagorii* probably belongs, although it has a more elevated spire than most of the species of this section, being in this respect intermediate between the latter and *Lymnæa* proper.

The existence of fresh water shells in lakes or ponds where the water, through evaporation, is gradually becoming more alkaline, has been shown to be accompanied, in the lake-beds of the Great Basin of the western United States, by a tendency to solidification, thickening and corrugation or ribbing of the shells, regardless of their systematic relations. This goes on until the alkalinity becomes so great that molluscan life is no longer possible. We find in the fresh water Pliocene beds of Utah, *Lymnæa*, *Pompholyx*, *Carinifex*, *Physa* and *Planorbis* exhibiting these changes as we ascend in the beds, until the latter become barren of life. To these modifications we probably owe such forms as *Polyrhytis*, *Pleurolimnæa*, *Vorticifex*, etc. I have shown in another place[1] how such factors may be supposed to act in the case of land shells exposed to alkaline dust on tropical islands such as the Galapagos. While such changes are the result of the direct action of the environment on the individual, and not hereditary or evolutionary, it is nevertheless convenient to recognize the results in the systematic arrangement of the species.

Disregarding synonyms, which can be deduced from the preceding data, the general arrangement of the groups of the genus *Lymnæa* would be about as follows :

Subgenus **Lymnæa** s. s.

Section *Lymnæa* s. s. Shell thin, with an acute and slender spire and expanded last whorl; the axis twisted, forming a (usually pervious) spiral coil without a true umbilicus; the callus on the body closely appressed; the outer lip flaring more or less, simple, sharp, normally without any varical thickening. Type *L. stagnalis* (Linné). Holarctic.

Section *Bulimnea* Haldeman. Shell large and solid, bulimiform, with an impervious axis, a twisted or subplicate pillar, the callus on the body and pillar closely appressed, and the outer lip not thickened or expanded. Type *Lymnæa megasoma* Say. Nearctic.

[1] Proc. Acad. Nat. Sciences Phila., for 1896, pp. 406–426.

Section *Radix* Montfort. Shell thin, usually with a short spire and ample last whorl; the axis twisted but not gyrate, the outer lip often expanded, the inner one more or less elevated and continuous across the body, forming a more or less conspicuous umbilicus; the outer lip thin. Type *Lymnæa auricularia* (Linné). Holarctic.

The umbilicus in this group varies from a mere chink to a rather large orifice through which a bristle may be passed nearly to the apex of the shell.

Section *Cyclolimnæa* Dall, nov. Shell thin, involute, the last whorl as long as the shell, the outer lip thin, simple, not expanded, the inner lip appressed, the axis not plicate, but with a small umbilical chink. Type *Lymnæa involuta* Harvey. British. The mantle is said to be extended partly over the shell.

Section *Polyrhytis* Meek. Shell like *Radix*, but axially strongly ribbed. Type *L. kingi* Meek. Pliocene, N. Am.

Section *Acella* Haldeman. Shell thin, smooth, acute, extremely slender; the aperture expanded at the margin, the inner lip not appressed, a moderate chink behind it, the axis gyrate, pervious, not plicate; the outer lip simple, sharp. Type *L. gracilis* Jay. Nearctic.

Section *Pleurolimnæa* Meek. Shell like *Acella*, but axially prominently ribbed. Type *L. tenuicostata* Meek and Hayden. Eocene, N. Am.

Section *Galba* Schrank. Shell turrited, the whorls gradually increasing, smooth; the last whorl not inflated; the aperture moderate; the outer lip not expanded or thickened; the inner lip not appressed; the pillar not twisted or plicate, the axis minutely umbilicate. Type *L. truncatula* (Müller). Holarctic.

Subgenus **Stagnicola** Leach.

Section *Stagnicola* s. s. Shell elongate, smooth, the whorls gradually increasing, the last whorl moderate; the outer lip sharp, not expanded, with a varical thickening within, in the adult; the pillar distinctly plicate, the inner lip appressed, the axis slightly or not at all perforate. Type *L. palustris* (Müller). Holarctic.

Section *Leptolimnea* Swainson. Shell like *Stagnicola* but more cylindrical, with numerous whorls and a small aperture. Type *L. glaber* (Müller). Palearctic.

? Section *Physastra* Tapparone-Canefri. Shell like *Stagnicola* but with a coarse dehiscent periostracum and coiled sinistrally. Type *P. vestita* T.-C. Polynesian.

Genus **Erinna** Adams.

Shell small, with a short spire, a large final whorl; the aperture with a continuous peristome which passes behind a broad somewhat excavated pillar; axis imperforate and the pillar not plicate. Type *E. newcombi* Adams. Hawaiian.

Incertæ sedis.

Velutinopsis Sandberger. Shell almost planorboid, with few, rounded, rapidly increasing whorls; the aperture simple, suborbicular, the peristome sharp, simple, not reflected; the pillar lip broad, not appressed; the axis umbilicate. Type *L. velutina* Deshayes. Pliocene of the Crimea.

Tanousia Bourguignat. Shell small ovate conic, closely and almost involutely coiled; the last whorl inflated, subcarinate behind, the aperture contracted. Type *L. zrmanjæ* Brusina. Pleistocene of Dalmatia. The group was named *Sandria* by Brusina in 1885, *fide* Westerlund.

Zagrabica Brusina. Shell ventricose, with a short acute spire and few rounded whorls, rugose, umbilicate, the last whorl ample, with a rotund transverse aperture, and continuous peristome appressed on the columellar margin; the outer lip simple. The type is a Pleistocene fossil. A recent form from the Caspian has been referred to this group by Dybowski, under the name of *Z. brusiniana*.

I have not seen specimens, but the description reads as if the shell might be a member of the *Radix* group which has been modified by life in brackish water.

Lymnæa stagnalis Linné.

Helix stagnalis LINNÉ, Syst. Nat., ed. x, p. 774, 1758; ed. XII, p. 1249, 1767.
Lymnæa stagnalis LAMARCK, Prodr., p. 75, 1799.
Lymnæa jugularis SAY, Art. Conchology, Nicholson's Encyc., I (no pagination), 1817; 3d ed. (p. 6), 1819.—HALDEMAN, Mon. Limn., p. 16, pl. IV, 1841.
Lymnæa appressa SAY, Journ. Acad. Nat. Sci., Phila., II, p. 168, 1818.—HALDEMAN, Mon. Limn., p. 18, pl. V, 1842.
Limnæa stagnalis W. G. BINNEY, Land and Fw. Sh. N. Am., II, p. 25, figs. 28–32, 1865.

Range.—Europe, the Caucasus, western and northern Asia, the northern United States, Canada and British America.

Lake Superior, Lake Winnipeg! the Saskatchewan River! Carberry, Manitoba; Moose Factory, James Bay! Knee Lake, Keewatin! Slave River, 25 miles below Peace River! Great Slave Lake at Fort Rae! and Fort Resolution! Fort Simpson! and Fort Smith! on the Mac-

kenzie River; Fort Anderson, Lat. 68° N.! and Lake Harrison, Lat. 70° N! Shawnigan Lake, Vancouver Island! and Dall River, Lat. 66° N.! of the Yukon drainage in Alaska. The following additional localities are cited from the literature: York Factory, Keewatin, and the Nelson River; Egg Lake, Alberta; Red Deer, McLeod, and Olds; Lake Isle Lacrosse and Vermilion Lake; Lake Osoyoos, B. C. (but replaced west of the Cascades by *L. sumassii*, according to J. K. Lord); Syniakwateen Lake, B. C.; lakes in the Kenai Peninsula, Alaska (Wossnessenski); Stewart River, Yukon district (Canadian Geol. Survey).

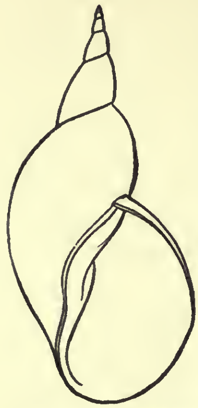


FIG. 42. *Lymnæa stagnalis.*

It seems unnecessary to cite the multitudinous varietal names bestowed on the mutations of this species in Europe. In a wide sense it is one of the most easily recognizable of fresh water shells, as it is one of the most conspicuous of circumboreal species.

Lymnæa petersi n. sp. Plate II, fig. 3.

Shell extremely thin, of five or more tumid rapidly enlarging whorls; spire acute, the suture deep; whorls rounded, the periphery nearer the preceding suture; shell of a blackish brown, polished, finely sharply spirally striate; periostracum brownish, darker at resting stages; aperture oval, a thin wash of callus on the body; pillar very thin, gyrate, the gyrations pervious; the outer lip not thickened. Height 16; max. diam. 8; height of aperture 8.5; width 5.2 mm.

Range. — Koyukuk River, north of the Yukon in Alaska; W. J. Peters of the U. S. Geological Survey.

This very delicate and pretty species appears to belong to the typical *Lymnæa* in spite of its small size; it has much the aspect of a minute *L. randolphi*, but has more whorls in less than half the height, and is of quite a different color and without angularity to the whorls.

Lymnæa atkaënsis Dall. Plate II, figs. 8, 10.

Limnæa atkaënsis DALL, Proc. U. S. Nat. Mus., VII, p. 343, 1884.

Range. — Lake on the island of Atka, Aleutian chain, near Korovin Bay.

Shell with about four ovate whorls rapidly increasing, of a dark olive sometimes purplish tint, very thin, malleated, microscopically reticulated, with obscure revolving ridges; the aperture ovate, not expanded, the margins thin, that on the pillar narrowly reflected;

pillar gyrate, pervious, in the early whorls widely so, a condition concealed in the adult.

This form grows in a region containing little lime, and the shells are extremely thin and often eroded into holes, which exhibit the peculiarities of the axis by which the species is relegated to the typical Lymnæas, though externally it has much the appearance of a small *Radix*. The species has been figured in the newer portion of the Conchylien Cabinet, but I have not the reference at hand.

Adults measure:

Height.	Max. Diam.	Height of Aperture.	Width.	Whorls.
26.5	16.5	16.5	10.5	4
24.0	13.0	14.0	9.2	3½
17.0	11.5	11.2	7.5	4½

*** Lymnæa lepida** Gould.

Limnæa lepida GOULD, Proc. Boston Soc. Nat. Hist., II, p. 211, 1847; Moll. U. S. Expl. Exp., p. 121, figs. 141, 141*a*, 1852.—BINNEY, Land and Fw. Sh. N. Am., II, p. 29, fig. 33, 1865.

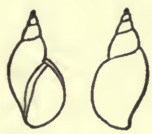


FIG. 43. *Lymnæa lepida* Gould.

Range.—Lake Vancouver, Oregon (Wilkes); near Challis, Idaho (Merriam)!

A species existing near the boundary and doubtless to be found in southern British Columbia.

*** Lymnæa (Bulimnea) megasoma** Say.

Lymnæus megasomus SAY, Rep. Long's Exp., II, p. 263, pl. XV, fig. 10, 1824.—KÜSTER, Conch. Cab., ed. II, *Limnæa*, p. 36, pl. VI, figs. 20, 21.

Limnea megasoma HALDEMAN, Mon. Limn., p. 13, pl. III, figs. 1–3, 1841.—WHITFIELD, Bull. Am. Mus. Nat. Hist. N. Y., I, No. 2, p. 29, pl. V, 1882.

Limnæa megastoma SOWERBY, Conch. Icon., XVIII, pl. II, fig. 12, 1872.

Limnæa megalosoma SANDBERGER, Conch. d. Urw., p. 581, 1873.

FIG. 44. *Lymnæa megasoma* Say.

Range.—Northern New England, Canada and British America to Lat. 57° N.

Lake Superior! Vermilion Lake, H. B. T.; to Etchimamish Lake, in Lat. 57° between the Nelson River and the Height of Land, Keewatin; Bois Blanc Lake, Manitoba!

The British American localities are cited from the literature, and except the last I have been unable to verify them by an examination of authentic specimens.

Lymnæa (Radix) mighelsi Binney.

Limnæa decollata MIGHELS, Proc. Boston Soc. Nat. Hist., I, p. 49, 1841.— MIGHELS and ADAMS, Boston Journ. Nat. Hist., IV, p. 336, pl. IV, fig. 13 (four views), 1842.
Limnea catascopium HALDEMAN, Mon. Limn., p. 52, 1842 ; not of Say.
Limnæus decollatus KÜSTER, Conch. Cab., ed. II, Mon. Limn., p. 45, pl. VIII, figs. 11–14, 1862.
Limnæa ampla MIGHELS, Boston Journ. Nat. Hist., IV, p. 347, pl. XVI, figs. 1*a*–1*c*, April, 1843 ; not of Hartmann, 1842.—BINNEY, Land and Fw. Sh. N. Am., II, p. 30, figs. 34–35, 1865.
Limnæa mighelsi, W. G. BINNEY, Land and Fw. Sh. N. Am., II, p. 31, footnote, 1865.
Limnæa angulata SOWERBY, Conch. Icon., XVIII, Mon. *Limnæa*, pl. VII, fig. 47, Dec., 1872.
Limnæa emarginata SAY, var. *mighelsi* BINNEY, Nylander, Distr. of *Limnæa*, etc., pls. I–IV, 1901.

Range.—Aroostook Co., Maine; Province of Quebec; northern Michigan?

Aroostook Co., Maine! Brome Lake, Province of Quebec! Lake Namakan, north of Lake Superior, western Ontario; Lake of the Woods, Manitoba.

The earliest name of this species is *decollata*, which was applied to a stunted variety living in acidulous water which destroyed the early whorls. This name, however, being quite inapplicable to the normal shell, would best be kept for the shells to which it was applied, and retained in a varietal sense. After an examination of Say's types of *L. emarginata* I am quite confident, as species go in *Lymnæa*, that it is distinct from the present form, which I have never seen from the Western region. This species, *L. mighelsi*, is apparently a representative of *Radix*, while the thickening of the outer lip internally in *L. emarginata* var. *canadensis* leads to the suspicion that it is related to *Stagnicola*. Owing to the manner in which various forms of *emarginata* have been summarily united with *L. mighelsi* by reputable students, I shall on the present occasion waive this doubt and proceed to its immediate consideration. It may, however, be pointed out that W. G. Binney seems to have been of the same opinion when, in 1865, he placed *L. emarginata* in the same group as *L. palustris*.

FIG. 45. *Lymnæa mighelsi*, ½.

Lymnæa (Stagnicola?) emarginata Say.

Lymneus emarginatus SAY, Journ. Acad. Nat. Sci. Phila., II, p. 170, 1821 ; Long's Exp. Rep., II, p. 263, 1824 (Maine).
? *Limneus emarginatus* SAY, Am. Conch., VI, pl. 55, fig. 1, 1834.
Limneus ontariensis MÜHLFELDT in Küster, 1862, *fide* W. G. Binney, *op. cit.*, p. 52, 1865.

Limnea emarginata HALDEMAN, Mon. Limn., p. 10, pl. II, figs. 4–5, 1841.
? *Limnea serrata* HALDEMAN, Mon. Limn., p. 12, pl. II, fig. 7, 1841 (pathologic specimen, figure copied by Binney, *op. cit.*, p. 52, fig. 78).
Limnæa scalaris WESTERLUND, Vega Exp. Vet. Iakt., IV, p. 201, pl. IV, fig. 13, 1885. Not *L. scalaris* A. Braun, 1853, or Sowerby, 1872.
Limnæa canadensis SOWERBY, Conch. Icon., XVIII, Mon. *Limnæa*, pl. VII, figs. 45, *a–b*, 1872.

Range. — Northern United States east of the Mississippi, Canada, and northwestward.

Lakes in northern Maine (Say)! Lake Champlain and Ontario; Crooked Lake, Emmet Co., Michigan! English River, Keewatin, Hudson Bay! Port Clarence, Alaska (Vega Expd.).

FIG. 46. *Lymnæa emarginata* Say.

After considerable study I have been forced to the conclusion that several species were identified under this name by Say himself, as well as others. Say's figure is wretched and does not represent the typical form from Maine, as at first described. The latter is apparently represented by specimens labelled by Say himself, still preserved in the Academy at Philadelphia, and which must be regarded as typical. The shell is small, with an acute spire; one of the specimens has the suture deeply impressed, but not the others, which seem more normal. Westerlund's figure fairly represents the species; Sowerby's *L. canadensis*, judging from specimens compared with the types by Mr. E. A. Smith of the British Museum, is probably the same, though the shells are heavier and larger, with the lip thickened internally, and a marked umbilicus. I should not, in default of this comparison and if obliged to depend on Sowerby's figures, have felt justified in uniting them.

Lymnæa (Radix) binneyi Tryon.

Limnæa binneyi TRYON, Am. Journ. Conch., I, p. 229, pl. XXIII, fig. 3, 1865 (Hellgate River, Oregon).
Limnæa ampla TRYON, Mon. Freshw. Univ. Moll., part II, p. 91, 1872, *ex parte*, not of Mighels.

Range. — Northern United States west of Lake Huron and the adjacent British possessions.

Lake Higgins, southern Michigan! Lake Houghton, northern Michigan! east of Fort Colville, Wash.! Fort Vancouver, Columbia River! Sumas Prairie, B. C.! Vancouver Island; Clear Lake, Athabaska, N. Lat. 56°! Lake Isle Lacrosse, Athabaska! English River, Manitoba!

This species appears to be quite recognizable but has been frequently distributed under the name of *L. sumassi* or *ampla*, with the latter of

which Tryon himself at one time confounded it. It has a short spire with appressed or moderately conspicuous suture, ovate form, tumid whorls, pale color, well marked umbilicus, and fine spiral striation. The largest specimen I have seen measured 27 mm. high and 18 mm. in maximum diameter; but the average adult is about 24 × 15 mm. I have not seen any specimens angulated at the shoulder.

Lymnæa (binneyi var.?) preblei Dall, nov. Plate 1, figs. 1, 2.

A shell which when young is almost identical with *L. binneyi*, and which may prove merely a giant growth of it, occurs in the Hudson Bay drainage. When full grown it has six whorls, with much the same contour as *Bulimnea megasoma*, the last whorl being much the largest, moderately expanded, and somewhat produced in front. The umbilicus is deep and partly hidden by the reflected pillar lip, which is continuous and more or less raised across the body. There is no fold on the pillar. The surface, when in perfect condition, is minutely but sharply sagrinate by the intersection of axial and spiral striæ, and is often malleate besides. The shell is nearly white or pale straw color.

Adults measure:

Whorls.	Height.	Max. Diam.	Height of aperture.	Diam.
6	37	23	22.5	13 mm.
5.5	38	26	26	19 "

Range. — English River, Manitoba (Kennicott)! Knee Lake, Keewatin (E. A. Preble)!

This form is remarkable for its size, its surface, and its deep umbilicus. The resemblance of its profile to that of *L. megasoma* is so marked that one wonders whether some of the records of the latter species from high northern localities may not have been based on specimens of this form. They are easily separated, however, if one pays attention to the other characters, and the present form probably never attains the solidity and rich coloration so characteristic of *megasoma*.

FIG. 47. *Lymnæa columella.*

Lymnæa (Radix?) columella Say.

Lymnæa columella SAY, Journ. Acad. Nat. Sci. Phila., I, p. 14, 1817.
Lymnæus columellus SAY, Journ. Acad. Nat. Sci. Phila., II, p. 167, 1821.
Limnea columella HALDEMAN, Mon. Limn., p. 38, pl. XII, figs. 13–15, 1842.
—BINNEY, Land and Fw. Sh. N. Am., II, p. 32 (*ex parte*), fig. 38, 1865.

Range.—Manitoba to New England, New Mexico, and Georgia. Lake Superior! Lake Winnipeg (Rich)!

This attractive species is readily recognized by its *Succinea*-like form and fine spiral sculpture. The synonymy as given by Binney and others seems to need revision. I am not of the opinion that this form belongs properly in the *Radix* group, as it has several features in common with *Stagnicola*, notwithstanding the form of the shell. An anatomical examination will decide the question.

Lymnæa (Radix) randolphi F. C. Baker, Plate 1, figs. 3, 4.

Lymnæa randolphi BAKER, Nautilus, XVIII, No. 6, p. 63, Oct., 1904.

Shell large, thin, angulate or subangulate at the shoulder; constricted strongly at the suture, narrowly and deeply umbilicate, whorls about four, rapidly increasing in size but frequently decollate; when entire the spire is less in length than the aperture but the proportion is variable; in conformity with the sutural constriction the posterior angle of the aperture is usually somewhat narrow, the apertural margin continuous over the body, with a narrow deep umbilicus over which the pillar lip may be reflected. The pillar is sometimes slightly sinuous but not plicate, the surface may be smooth and polished, malleated, spirally threaded or minutely reticulated by axial and spiral lines. The periostracum is pale, but usually has a dark line at resting stages; the outer lip is hardly expanded though often a little patulous in front; it is never internally thickened. Measurements:

Whorls.	Height.	Max. Diam.	Height of aperture.	Width.
3.5	31	19	18	11.0 mm.
4	41	23	24	15.5 "
4	35	27	24	15.6 "

Range.—Lake near Cosmos River, north of the Kowak River, Alaska, about N. Lat. 68° (Lieutenant Stoney)! Kowak River, Alaska (Stoney)! Nushagak River, Alaska! Lake Marsh! and Lake Lindeman, Yukon Territory! Lake La Hoche, British Columbia! East of Fort Colville, Wash.!

This form is very recognizable, with its angular whorls and deeply constricted suture. A specimen from near Fort Colville, figured by Binney as a possible variety of *L. sumassi* Baird (*op. cit.*, p. 43, fig. 58), may prove a feebly angulated and unusually short spired specimen of this species. I have received it under the names *ampla*, *sumassi*, etc., from several Pacific Coast correspondents, and a large number of mostly defective specimens were obtained by the expedition into northwestern

Alaska commanded by Lieutenant Stoney, U. S. N. The true *L. sumassi* Baird is apparently a *Stagnicola*, but the present species belongs to *Radix*. It is not in the least like *L. mighelsi* (*ampla* Mighels) though often given that name.

Lymnæa (Acella?) kirtlandiana Lea.

? Limnæa exilis LEA, Trans. Am. Phil. Soc., v, p. 114, pl. XIX, fig. 82, 1837. Ohio.

Limnæa kirtlandiana LEA, Proc. Am. Phil. Soc., II, p. 33, 1841; Trans. Am. Phil. Soc., IX, p. 12, 1842. — BINNEY, Land and Fw. Sh. N. Am., II, p. 67, 1865.

Limnæa lanceata GOULD, Proc. Boston Soc. N. Hist., III, p. 64, 1848. — AGASSIZ, Lake Superior, p. 244, pl. VII, figs. 8, 9, 1850. — TRYON, Mon. Limn., pt. 2, pp. 112–113, pl. XVIII, figs. 10, 11, 1872.

Range. — Ohio to Nebraska, and northward.

Poland, Ohio! Iowa River, Iowa! Apple Creek, Nebraska! Pic Lake, north of Lake Superior, in western Ontario!

FIG. 48. *Lymnæa kirtlandiana* Lea.

The original types of Lea's *Limnæa exilis* are in the National Museum, and after a careful examination of them I am inclined to believe that they are somewhat abnormal dead specimens of this species rather than a mutation of *L. reflexa*, as supposed by Binney; unless we extend *L. reflexa* to cover the whole group, which seems to me unwarranted. *L. lanceata* is an immature specimen of what was earlier called *kirtlandiana* by Lea. The figures of both these forms in Binney's work are uncharacteristic, especially that of *lanceata*, which shows nothing of the "flatness of its whorls" referred to by Gould in his remarks.

These shells have all the characteristics of *Acella* except that they are less fragile, larger, and darker colored. They have the gyrate pillar of *Lymnæa* and not the plicate columella of *Stagnicola*, which in other respects they recall. Until an exhaustive anatomical and experimental study of these animals is made, all group-references must be merely tentative.

Lymnæa (Galba) truncatula Müller.

Buccinum truncatulum MÜLLER, Verm. Terr. et Fluv., II, p. 130, 1774 (Europe).

Limneus minutus DRAPARNAUD, Tableau, p. 51, 1801; Hist., p. 53, pl. III, figs. 5–6, 1805 (France).

Limnæa ferruginea HALDEMAN, Mon. Limn., pt. 3, third page of cover, Mar. 13, 1841; pt. 4, p. 49, pl. 13, figs. 19, 20, 1842 (Oregon).

Range. — Europe, northern Asia and America.

Bering Id., Commander Islands, Bering Sea! Kadiak Island, Alaska! ponds near Yakutat Bay, Alaska (Kincaid)! Fort Simpson, Mackenzie River (Kennicott)! near Brandon, Manitoba (Christy)! Oregon (Nuttall); Hannah Bay (out of James Bay) near Moose Factory!

Specimens absolutely identical with those from Europe have been collected from the indicated localities. It is quite likely that some of the specimens reported by collectors under the name of *humilis* or *desidiosa* may have belonged to this species. The form called *ferruginea* by Haldeman seems to differ only by having the pillar lip more closely appressed, a character which any large series will show to be inconstant in individuals among themselves as well as in the same individual in different stages.

FIG. 49. *Lymnæa truncatula* Müller. (European specimen.)

Lymnæa (Galba) humilis Say.

Lymneus humilis SAY, Journ. Acad. Nat. Sci. Phila., II, p. 378, 1822 (South Carolina).

Limnea humilis (SAY) HALDEMAN, Mon. Limn., p. 41, pl. 13, fig. 1, 1842 (syn. exclus.). — BINNEY, Land and Fw. Sh. N. Am., II, p. 63, fig. 99, 1865.

FIG. 50. *Lymnæa humilis* Say. (Typical.)

Range. — From Georgia and Kansas northward. Lake Superior; Lake Winnipeg; Brandon; and Pembina Mt., Manitoba.

I have been unable to examine any authentic specimens from north of Lat. 49°, and the above localities are cited from the literature.

Lymnæa (Galba) desidiosa Say.

Lymneus desidiosus SAY, Journ. Acad. Nat. Sci. Phila., II, p. 169, 1821 (Cayuga Lake, N. Y.).

Limneus desidiosus SAY, Am. Conch., VI, pl. 55, fig. 3, 1834.

Limnea desidiosa HALDEMAN, Mon. Limn., p. 31, pl. X, 1842 (*ex parte*). — BINNEY, Land and Fw. Sh. N. Am., II, p. 49, fig. 68, 1865.

FIG. 51. *Lymnæa desidiosa* (*obrussa*) Say.

Range. — Northern United States and northward. Red Deer and McLeod, Alberta. Lower Saskatchewan near Lake Winnipeg; Brandon; Manitoba. Osoyoos Lake, British Columbia (J. K. Lord *fide* P. P. Carpenter).

The above localities are cited from the literature.

Lymnæa (Galba) galbana Say.

Lymneus galbanus SAY, Journ. Acad. Nat. Sci. Phila., V, p. 123, 1825 (New Jersey Pleistocene).

Limnea galbana HALDEMAN, Mon. Limn., p. 51, pl. XIII, figs. 22, 23, 1842.
Limnæa philadelphica LEA, Proc. Am. Phil. Soc., II, p. 32, 1841; Trans. Am. Phil. Soc., IX, p. 8, 1844.—BINNEY, Land and Fw. Sh. N. Am., II, p. 50, fig. 71, 1865. (Philadelphia, Pa.)
Limnæa traski TRYON, Proc. Acad. Nat. Sci. Phila., for 1863, p. 149, pl. 1, fig. 13, 1863.—BINNEY, Land and Fw. Sh. N. Am., II, p. 60, fig. 94, 1865.—TRYON, Mon. Limn., p. 119, pl. 17, fig. 3 (not p. 96, nor fig. 2), 1872. (Mountain Lake, near San Francisco, Calif.) Not *L. traskii* Lea, 1864, nor *L. proxima* Lea, 1856.


FIG. 52. *Lymnæa galbana* Say var. *philadelphica* Lea.

Range.—Pleistocene marls of Franklin, New Jersey; of Anticosti Island! of Ottawa, Canada! and of the left bank of the Yukon River, Alaska, below old Fort Yukon! Recent, at the Grand Rapids of the Saskatchewan River, near Lake Winnipeg! Grindstone Creek, Nebraska! Centre City, Pennsylvania! Vancouver, Columbia River! and near Monterey, California! Alaska (von Martens); Attawapiskat River, S. E. Keewatin! (McInnes).

This small species has the spire acute and short, the last whorl disproportionately swollen and usually shouldered. It appears to have flourished during the melting of the glacial ice, and to the muddy waters of the period its peculiarities may be due. The recent form seems less abnormal on the average.

There are two species which have been called *traskii*—the present one, with which Tryon afterward mistakenly united *L. proxima* Lea, a much larger species; and *L. traskii* Lea, later called *tryoni* and *tryoniana* by Dr. Lea, which is a *Stagnicola.*


FIG. 53. *Lymnæa holbolli.*

Lymnæa (Galba) holbolli (Beck) Möller.

Limnæa (*Limnophysa*) *holbolli* BECK, Index, p. 111, 1838; nude name. Greenland.
Lymnæa holbolli MÖLLER, Index, Moll. Grönl., p. 5, 1842.
Limnæa holbolli MÖRCH, Am. Journ. Conch., IV, p. 36, pl. IV, fig. 8, 1868.

Range.—Godhaab, Greenland.

This has the appearance of a large *L. truncatula*, but may be merely a depauperate variety of the next species.

Lymnæa (Galba) vahlii (Beck) Möller.

Limnæa (*Limnophysa*) *vahlii* BECK, Index, p. 111, 1838; nude name. Greenland.
Limnæa vahlii MÖLLER, Index, Moll. Grönl., p. 4, 1842.
Limnæa (*Limnophysa*) *vahlii* MÖRCH, Am. Journ. Conch., IV, p. 34, pl. IV, figs. 1–7, 1868.

Limnæa (*Limnophysa*) *senegalensis* BECK, Index, p. 111, 1838 (nude name), *fide* MÖRCH, *op. cit.*, p. 35, footnote.
Limnæa grönlandica (BECK, MS.) JAY, Cat. Coll., 1850, p. 269, No. 6298. — MÖRCH, *op. cit.*, p. 33.
Limnæa mölleri BECK, Naturf. Vers. Kiel, p. 123, No. 4, nude name.—GERSTFELDT, Land and Sussw. Conch. Sibiriens, p. 37, 1859.
Lymnæa pingelii (BECK) MÖLLER, Index Moll. Grönl., p. 5, 1842. — MÖRCH, Am. Journ. Conch., IV, p. 35, 1868, *et vars. nitida et solidula et malleata* Mörch, *l. c.*
Lymnæa wormskioldi BECK, Naturf. Vers., Kiel, p. 123, No. 7, nude name. — MÖRCH, Am. Journ. Conch., IV, p. 35, pl. IV, fig. 6, 1868.
Limnæa vahlii var. *leucostoma* MÖRCH, Prod. Moll. Grönl., p. 4, No. 11 β; also var. *minor* MÖRCH, Am. Journ. Conch., IV, p. 34, 1868.
Limnæa vahlii var. *elongata* MÖLLER (MS.), in Mörch, Am. Journ. Conch., IV, p. 40, pl. IV, fig. 1, 1868.
Limnæa arctica LEA, Journ. Acad. Nat. Sci. Phila., VI, p. 160, pl. XXIV, fig. 75, 1866. Hudson Bay.

Range. — Greenland to Alaska and south to Minnesota and British Columbia.

Ft. Resolution! and Ft. Rae, Great Slave Lake! Moose River, at Moose Factory, Hudson Bay! Greenland (many localities)! Ungava, Labrador! Weatoga, Canada! Minnesota (Lapham)! Stewart and

FIG. 54. *Lymnæa vahlii* Möller. (Typical.)

FIG. 55. *Lymnæa vahlii* var. *pingelii* Möller.

Dall Rivers, north of the Yukon, Alaska! St. Michaels, Norton Sound, Alaska! headwaters of the Yukon in Lakes Bennett, Marsh, and Lindeman! Loring, Southeastern Alaska, on Behm Canal! Shawnigan Lake, British Columbia! Headwaters of the Liard River in Lakes Finlayson and Frances! Hannah Bay near Moose Factory!

Making the usual allowances for variation, this is a fairly well discriminated species, which frequently has been identified as *L. desidiosa*, *palustris*, etc. The largest are more fragile, smaller and paler than *L. palustris*, and not especially similar to it. I have had the advantage of being able to consult a very large series of authentically named Greenland shells, received from Mörch and others, as well as the fine Arctic series in the National Museum. Most of the specimens are microscopically wrinkled on the surface, like *L. palustris*, but this character is not absolutely constant.

Lymnæa (Stagnicola) palustris Müller.

Buccinum palustre MÜLLER, Verm. Terr., II, p. 131, 1774.
Limneus palustris DRAP., Hist., p. 52, pl. II, figs. 40–42, III, figs. 1–2, 1805.
Stagnicola communis LEACH, in Jeffreys, Linn. Trans., XVI, II, p. 376, 1830.— RÖSSMÄSSLER, Icon., I, p. 96, figs. 51, 52, 1835.— TURTON, Man., p. 121, 1831.— GRAY'S Turton, p. 237, 1840.— LEACH, Syn. Moll. Gt. Brit., p. 103, 1852.
Limnæus elodes SAY, Journ. Acad. Nat. Sci. Phila., II, p. 169, 1821; Am. Conch., IV, pl. XXXI, fig. 3, 1832.
Limnæa elodes GOULD, Inv. Mass., p. 221, figs. 146–7, 1841.

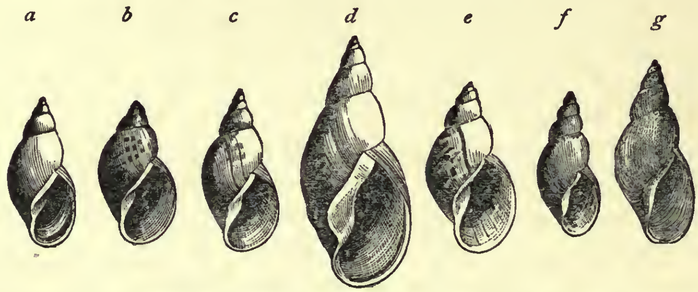


FIG. 56, *a–f*. *Lymnæa palustris* Müller vars. FIG. 56, *g*. var. *rowelli* Lea from Pacific Coast.

Limnea fragilis HALDEMAN, Mon. Limn., p. 20, pl. VI, pl. XV, fig. 1, 1842; not of Linné.
Limnæa nuttalliana LEA, Proc. Am. Phil. Soc., II, p. 33, 1841.— BINNEY, Land and Fw. Sh. N. Am., II, p. 45, fig. 6, 1865.
Limnea expansa HALDEMAN, Mon. Limn., p. 29, pl. IX, figs. 6–8, 1842 (pathologic mutation).
Limnæa haydeni LEA, Proc. Acad. Nat. Sci. Phila., p. 166, 1858.— BINNEY, *op. cit.*, p. 44, fig. 59, 1865 (pathologic mutation).
Limnæa plebeia GOULD (nude name), in Adams, Am. Journ. Sci., XL, p. 268.
Limnæa proxima LEA, Proc. Acad. Nat. Sci. Phila., VIII, p. 80, 1856.— BINNEY, *op. cit.*, p. 48, fig. 67, 1865.

FIG. 57. *Lymnæa palustris* var. *nuttalliana*.

Range.— Circumboreal. Northern United States and Canada.

Manitoba: Lake Winnipeg; Saskatchewan River! Lake of the Woods; Red River of the North! Pembina; Turtle Mt.; Carberry. York Factory! Keewatin. Ungava! Labrador. Alberta: Laggan; Egg Lake; Red Deer; McLeod; Olds. English River, Keewatin! Moose Factory, Keewatin; Slave River, 25 miles below Peace River! Great Slave Lake at Fort Resolution! Fort Smith, Mackenzie River! Upper Mackenzie River! Great Bear Lake; Anticosti Island; Cypress Hills! Assiniboia.

California! Oregon! Seattle, Wash.! Sumas Lake, British Columbia; Vancouver Island! headwaters of the Yukon! Lake Marsh! Lake Lindeman! Old Fort Yukon, Alaska! Saccatalontan and Nulato! Lower Yukon, and in the Yukon delta! Dall River! north of the Yukon in Alaska. Point Romanof, Norton Sound, Alaska! Avacha Bay, Kamchatka! etc.

This well known species is almost universally distributed in the quiet waters of boreal America, and in the Pleistocene marls. The distinctions which have been relied on to separate *L. haydeni* Lea, and *L. expansa* Haldeman, are due to pathologic mutations. *L. nuttalliana* and *proxima* Lea, are trivial varieties.

Lymnæa (Stagnicola) reflexa Say.

Lymneus reflexus SAY, Journ. Acad. Nat. Sci. Phila., II, p. 167, 1821; Am. Conch., IV, pl. XXXI, fig. 2, 1832 (Lakes Erie and Superior).
Limneus elongatus SAY, Journ. Acad. Nat. Sci. Phila., II, p. 167, 1821; not of Draparnaud, 1805.
Limneus umbrosus SAY, Am. Conch., IV, pl. 31, fig. 1, 1832 (new name for *elongatus* Say).
Limnæa exilis LEA, Trans. Am. Phil. Soc., V, p. 114, pl. XIX, fig. 82, 1837 (pathologic mutation).


FIG. 58. *Lymnæa reflexa* Say.

Range. — Northern United States and Canada.

Prairie Lake, near Red River of the North; and Beaver Creek, Manitoba.

This species barely crosses the boundary and may be one of those captured by the northward drainage when the headwaters of the Mississippi were interrupted and turned northward by the changes in the land levels of this region which have been elucidated by the late General G. K. Warren.

Lymnæa (Stagnicola) catascopium Say.

Lymnæa catascopium SAY, Nicholson's Encycl., Am. ed., II (no pagination), pl. 2, fig 3, 1817 (Delaware River).
Lymnæus catascopium SAY, Am. Conch., VI, pl. 55, fig. 2, 1832.
Lymnea cornea VALENCIENNES, in Humboldt and Bonpland, Rec. d'obs. de Zool., II, p. 251, 1832.
Limnæa sumassi BAIRD, Proc. Zool. Soc. London, 1863, p. 68. — BINNEY, Land and Fw. Sh. N. Am., II, p. 43, fig. 57 (not fig. 56), 1865 (British Columbia).

Range. — *L. catascopium* · Northern United States to the Rocky Mountains, Canada and northward; var. *sumassi:* Idaho, Washington and British Columbia.

Ottawa, Canada! Ungava, Labrador! Lake Winnipeg, Manitoba! Hudson Bay drainage of Keewatin! Moose River at Moose Factory,

Hudson Bay! Fort Resolution, Great Slave Lake! Winisk, Kawinogans, and Attawapiskat Rivers, S. E. Keewatin! (McInnes).

FIG. 59. *Lymnæa catascopium* Say, var. *sumassi* Bd. (British Columbia).

FIG. 60. *Lymnæa catascopium* Say (Delaware).

Var. *sumassi:* Snake River, Idaho! Lake Washington, Seattle! Sumas Prairie, British Columbia.

Quite variable and frequently confounded with *L. adelinæ*, *L. bulimoides*, *L. solida*, etc. The Pacific Coast form is quite close to the typical form of the species, but is thinner, less uniform, and sometimes larger. Binney's figure 57 is made from a specimen probably of a rather swollen variety of *palustris*.

*** Lymnæa (Stagnicola) adelinæ** Tryon.

Limnæa adelinæ TRYON, Mon. Limn., p. 82 (108), pl. XVIII, fig. 6, 1872 (San Francisco, Calif.).

Range. — California to Vancouver Island, B. C.

A small species, recalling *L. bulimoides* rather than *catascopium*, and perhaps identical with Lea's original *bulimoides*, as indicated by his types, but not with *L. techella* Haldeman, which is very generally labelled *bulimoides*.

FIG. 61. *Lymnæa adelinæ*.

Lymnæa (Stagnicola?) perpolita n. sp. Plate II, figs. 6, 8.

Shell small, translucent, dark amber color, with a darker line at resting stages; smooth, except for fine lines of growth, brilliantly polished; whorls four, tumid, rapidly increasing, separated by a pronounced suture; spire short, rather obtuse; aperture ovate, longer than the spire, with a very thin wash of callus on the spire, the pillar lip slightly reflected, with a small perforate umbilicus behind it; pillar straight, with no twist or fold, outer lip thin, sharp. Length of shell 11; of aperture 7; breadth of shell 8.5; of aperture 4.5 mm.

Range. — Nushagak, Bristol Bay, Alaska.

This shell is so elegantly polished that it may be an *Amphipeplea*. It has the rich dark amber color of some Succineas. I have seen but

one specimen, but some young shells from Sonoma Co., Calif., collected by Hemphill, may belong to it. The latter are proportionally stouter and are of a pale straw color. The polish of the surface and the straight pillar are alike in both, yet I hesitate to unite them. No other American species has an equally polished surface so far as I have observed.

Lymnæa (Stagnicola) bulimoides Lea.

Limnæa bulimoides LEA, Proc. Am. Phil. Soc., II, p. 33, 1841; Trans. Am. Phil. Soc., IX, p. 9, 1844. — HALDEMAN, Mon. Limn., p. 44, pl. XIII, figs. 9, 10, 1842. — BINNEY, *op. cit.*, p. 61, fig. 96, 1865 (Oregon).

Range.—Oregon, California, Texas, New Mexico, Dakota, the United States west of the Mississippi (and northward?)

FIG. 62. *Lymnæa bulimoides* Lea. (Typical.)

Oregon! (Nuttall) Columbia River near Fort Vancouver, Wash.! Moose Rivei at Moose Factory, Hudson Bay (Drexler)?

This species has been generally confounded with *L. techella* Haldeman, which seems to be distinct, having a more stumpy form and larger umbilicus, recalling, as Binney observes, his *Bulimulus pilula*. According to Lea's types, very few of the localities cited for this species, away from the Pacific Coast, are reliable. I suspect the shell from Hudson Bay, collected by Drexler, is a young *catascopium* or *caperata* and not the true *bulimoides*.

Lymnæa (Stagnicola) caperata Say.

Lymneus caperatus SAY, New Harmony Disseminator, II, p. 230, 1829.
Limnea caperata HALDEMAN, Mon. Limn., p. 34, pl. XI, figs. 1–9, 1842.
Limnæa umbilicata ADAMS, Am. Journ. Sci., XXXIX, p. 374, 1840; Boston Journ. N. Hist., III, p. 325, pl. III, fig. 14, 1840. — GOULD, Inv. Mass., p. 218, fig. 149, 1841.

FIG. 63. *Lymnæa caperata.*

Range. — Northern United States, west to the Rocky Mountains and northward.

Manitoba; at Pine Creek, Pembina, and Lake Winnipeg. Alberta; at Red Deer and McLeod. The lower Saskatchewan near Lake Winnipeg. Hudson Bay drainage at Moose Factory. I feel strong doubts as to the validity of this species, which may prove entirely heterogeneous.

Lymnæa (Stagnicola) anticostiana n. sp. Plate II, figs. 4, 5.

Shell acute, slender, with a blunt reddish nucleus and seven well-rounded whorls; suture deep, the whorls slowly enlarging; the last

whorl subcompressed laterally; aperture elongate-ovate, about 2¾ times its length being equal to the length of the shell; margin thickened, and continuous over the body, reflected over an umbilical chink behind the pillar but not quite closing it; pillar with a marked fold; surface with close-set fine axial elevated lines in harmony with the lines of growth, and crossed by microscopic revolving striæ which sagrinate the surface; there are also malleations, obscure sparse revolving ridges, etc., on individual specimens. Length of shell 19; aperture 7.0; max. diam. 7.0, of aperture 4.5 mm.

Range.—Pleistocene marl of Marl Lake, Anticosti Island (Sir William Logan and Dr. J. Schmitt). Recent?

This interesting species resembles somewhat *L. desidiosa*, to which it has usually been referred, but it has two more whorls and a more slender and elevated spire, and in most specimens a more parallel-sided aperture. I am unable to say whether it occurs in the recent state, but the numerous specimens I have seen are all fossils. Dr. Lea had labelled his specimens '*L. acuta* Lea,' doubtless forgetting his own species of the same name, which is a very different shell.

Uncertain Species.

There are several nude names in the literature which cannot be identified and yet may puzzle the student who is unaware that they have not been described. Of such are *L. fossaria* J. de C. Sowerby (1836), in Richardson's Fauna Boreali Americana; *L. petitii* Beck (1838), listed from Newfoundland in his 'Index'; and *L. opacina* Bell (1858), listed in the Annual Report of the Canadian Geological Survey.

Genus **Planorbis** Müller.

Planorbis PETIVER, Gazophyl. Nat. et Artis Dec., p. 16, tab. 10, fig. 11, 1702 (not binomial). The species figured is *Helix planorbis* Linné, Fauna Suecica, p. 527, 1761.—GUETTARD, Mém. Acad. Roy. des. Sci. (1756), p. 151, 1762 (not binomial), first sp. *Plan. brun.*, after Lister, Anim. Angl., p. 143, pl. II, fig. 26 (= *Helix corneus* Linné).—GEOFFROY, Traite Som. des Coq. Fluv. Paris, pp. 81, 84, 1767 (not binomial), § 1, *Helix cornea* Linné; *Ibid.*, translation by Martini, Nürnberg, pp. 10, 75, 1767.

Coretus ADANSON, Hist. Sénégal, p. 7, 1757 (not binomial), sp. figured resembles *P. parvus* Say.

< *Planorbis* MÜLLER, Verm. Terr., II, p. 152, 1774, no type selected; Prodr. Zool. Dan., pp. XXX, 238, 1775.—BRUGUIÈRE, Enc. Méth., I, p. XVI, 1789, nude name.—BOLTEN, Mus. Bolt., p. 51, 1798.—LAMARCK, Prodrome, p. 76, 1799; Syst. des An. s. Vert., p. 93, 1801.—DRAPARNAUD, Tabl. Coq. Terr. et Fluv., pp. 30, 42, 1801.—SCHUMACHER, Essai, p. 255, 1817; not of Perry, 1811.

= *Planorbis* MONTFORT, Conch. Syst., II, p. 270, 1810, selects as type *P. corneus* L.

Orbis SCHRÖTER, Journ. Steinr. u. Konch., III, p. 10, 1776, an error of citation for *Planorbis* Argenville.
Vortex Anonymous in Mus. Calonn., p. 58, 1797, *Helix cornea* Linné. Not *Vortex* Oken, 1815.
< *Anisus* STUDER, Syst. Verz., p. 23, 1820 (=*Planorbis* + *Physa*).
> *Anisus* FITZINGER, Verz., p. 111, 1833; not of Dujardin, 1821.
? *Cornu* SCHUMACHER, Essai, p. 255, 1817, not of Born, 1778.
> *Spiralina* HARTMANN, Syst. Uebers., tab. 1840. (Nude name.) No type cited.
Planorbarius DUMERIL, Zool. Anal., p. 164, 1806.
Coretus GRAY (not Adanson), P. Z. S., 1847, p. 180, *P. corneus* L. — MRS. GRAY, Figs. Moll. An., IV, p. 119, 1850.— MOQUIN TANDON, Moll. Terr. et Fluv., II, p. 423, 1855. — GRAY'S Turton's Man., ed. II, p. 233, 1857.
Spirodiscus STEIN, Schn. u. Muscheln Berlins, p. 73, 1850.—MÖRCH, Vidensk. Meddels. Kjobn., 1864, p. 309. — WESTERLUND, Acta Soc. Fauna Fennica, XIII, No. 7, p. 112, 1897; Acta Acad. Sci. Slav. Merid., Zagrabiæ, CLI, p. 120, 1902; *S. corneus* (Linné).
Tropidiscus WESTERLUND, Fauna Pal. Reg., V, p. 65, 1885, not of Stein; Acta. Acad. Sci. Slav. Merid., Zagrabiæ, CLI, p. 120, 1902; *Helix planorbis* Linné.
? *Caillaudia* BOURGUIGNAT, Hist. Mal. de l'Abyssinié, p. 128, 1883; 1st sp. *C. angulata* Bourg., pl. VIII, figs. 49–52, *op. cit.*— WESTERLUND, Acta Acad. Sci. Slav. Merid., Zagrabiæ, CLI, p. 139, 1902 (a deformed or monstrous form of *Planorbis*).

Subgenus **Planorbis** s.s.

Type *Planorbis corneus* Müller.

(Synonymy of the group given under the generic name.)

Section PLANORBINA Haldeman.

Planorbina HALDEMAN, Mon. Limn., *Physadæ*, p. 14, 1842, no type cited.
Menetus FISCHER, Man., p. 509, 1883; *P. guadeloupensis* Sowerby; not *Menetus* Adams, 1855.
Anisus GRAY, P. Z. S., 1847, p. 181; *P. olivaceus* Spix; not *Anisus* Studer, 1820.

Subgenus **Helisoma** Swainson.

Helisoma SWAINSON, Malac., p. 337, 1840; *P. bicarinatus* Sowerby.
Taphius H. and A. ADAMS, Gen. Rec. Moll., II, p. 262, 1855; *P. andecolus* Orbigny.
? *Anisopsis* SANDBERGER, Land u. Süssw. Conch. d. Vorwelt, p. 958, 1875; *P. loryi* Coq., and *P. calculus* Sandb., Jurassic.

Section PIEROSOMA Dall, nov.

Helisoma (sp.) Auct., not of Swainson; *P. trivolvis* Say.

Section PLANORBELLA Haldeman.

Planorbella HALDEMAN, Mon. Limn., *Physadæ*, p. 14, 1842; *P. campanulatus* Say.

Adula H. ADAMS, P. Z. S., 1861, p. 145; *P. multivolvis* Case, not *Adula* H. and A. Adams, 1857.
Ancæus H. ADAMS, P. Z. S., 1869, p. 275; not *Ancæus* Fauvel, 1863.

Subgenus **Tropidiscus** Stein.

Tropidiscus STEIN, Schn. u. Muscheln Berlins, p. 76, 1850; *P. complanatus* Stein (= *marginatus* Drap. + *umbilicatus* Müller).
Trophidiscus H. and A. ADAMS, Gen. Rec. Moll., II, p. 263, 1855, in synonymy.
Anisus FITZINGER, Verz, p. 111, 1833, *ex parte*, not of Studer, 1820, nor Dujardin, 1821.
Gyrorbis MOQUIN TANDON, Hist. Moll. Terr. et Fluv. de France, pp. 423, 428. 1885 (not of Fitzinger, 1833); *P. carinatus* Müller; Gray's Turton, new ed., p. 237, 1857.
Tropodiscus SURBECK, Moll. Faun. Vierwaldstattensis, Rev. Suisse de Zool., VI, p. 435, 1899.
> *Tropidiscus* WESTERLUND, Act. Soc. Fauna Fennica, XIII, p. 113, 1897, 1st sp. *P. umbilicatus* Müller.
> *Diplodiscus* WESTERLUND, *op. cit.*, p. 115, 1897, 1st sp. *P. vortex* Linné.

Section PARASPIRA Dall, nov.

Spirorbis SWAINSON, Malac., p. 337, 1840; *P. rotundatus* Poiret (+ *P. vulgaris* Swains.), not *Spirorbis* Daudin, *Vermes*, 1800.
Gyrorbis MÖRCH, Vidensk. Meddel. Kjöb., for 1863, p. 313, 1864, not of Fitzinger, 1833.
Planorbis (sp.) AGASSIZ, in Charpentier, Fauna Helv., p. 21, 1837.
Anisus (sp.) FITZINGER, Verz, p. 111, 1833; not of Studer, 1820.

Subgenus **Hippeutis** Agassiz.

Hippeutis AGASSIZ, in Charpentier, Fauna Helv., p. 22, 1837; *P. complanatus* Drap. (= *P. fontanus* Lightfoot). — HARTMANN, Syst. Uebers., table, 1840; Erd. u. Sussw. Gast., pp. 51, 87, 1844. — GRAY, in Turton's Man., ed. II, p. 243, 1857.— MÖRCH, Vidensk. Meddel., 1863, p. 316, 1864.
Hippeutes MRS. GRAY, Figs. Moll. An., IV., p. 119, 1859.

Section MENETUS H. and A. Adams.

Menetus H. and A. ADAMS, Gen. Rec. Moll., II, p. 262, 1855; no type selected (not of Chenu, 1869, or Fischer, 1883). — BINNEY, Land and Fw. Sh. N. Am., II, p. 125, 1865.
Menetus DALL, Ann. Lyc. N. Hist. N. Y., IX, p. 351, 1870; *P. opercularis* Gould. — CLESSIN, Conch. Cab., ed. II, XVII, p. 33, 1886. — WESTERLUND, Act. Acad. Sci. Slav. Merid., Zagrabiæ, CLI, p. 120, 1902, *P. boissyi* Pot. et Mich.
Heterodiscus WESTERLUND, *op. cit.*, 1902, not of Sharp, 1886, *Insecta*. *P. libanicus* Westerlund.

Section DREPANOTREMA Crosse and Fischer.

Drepanotrema C. and F., Miss. Sci. Mexique, II, pp. 59, 75, pl. XXXIII, fig. 2, 1880; *P. yzabalensis* C. & F.; Fischer, Man., p. 509, 1883.

Section BATHYOMPHALUS Agassiz.

Bathyomphalus AGASSIZ, in Charpentier, Fauna Helv., p. 20, 1837 ; *P. contortus* Drap. — HARTMANN, Syst. Uebers. Gast., table, 1840. — WESTERLUND Acta Acad. Sci. Slav. Merid., Zagrabiæ, CLI, p. 120, 1902.
Polygyrus GRAY, P. Z. S., 1847, p. 181 ; *P. contortus* Müller ; not of Beck, 1837, nor *Polygyra* Say, 1818.
Bathyomphalus GRAY, in Turton, Man., 2d ed., p. 244, 1857.
Discoidina STEIN, Schn. u. Muscheln Berlins, p. 82, 1850 ; *P. contortus* Müller.

Subgenus **Gyraulus** Agassiz.

Gyraulus AGASSIZ, in Charpentier, Fauna Helvetica, p. 21, 1837 ; 1st sp. *P. hispidus* Drap. (= *albus* Müller). — HARTMANN, Syst. Uebers., table, 1840 ; Gast., V, pp. 89, 95, 1844.— MOQUIN TANDON, Hist. Moll. Terr. et Fluv., II, p. 438, 1855.
Planaria BROWN, Ill. Conch. Gt. Brit., expl. pl. 51, figs. 48, 49*bis*, 1827 ; not *Planaria* Müller, 1776.
Trochlea HALDEMAN, Am. Journ. Sci., XLII, p. 216, 1841.
Giraulus MOQUIN TANDON, Hist. Moll. Terr. et Fluv. de France, II, p. 423, 1855.
Nautilina (pars) STEIN, Schn. u. Muscheln Berlins, p. 80, 1850.
Gyrulus GRAY, in Turton, Man., 2d ed., p. 234, 1857, *in syn.*
Gyraulus GRAY, *op. cit.*, p. 234, 1857, *P. albus* Müller.— WESTERLUND, Acta Acad. Sci. Slav. Merid., Zagrabiæ, CLI, p. 121, 1902.

Section ARMIGER Hartmann.

Armiger HARTMANN, Syst. Uebers., table, 1840 ; Gast., V, p. 172, 1842 ; *P. crista* (L.).— WESTERLUND, Acta Acad. Sci. Slav. Merid., CLI, p. 121, 1902.
Nautilina (sp.) STEIN, Schn. u. Muscheln Berlins, p. 81, 1850.

Section TORQUIS Dall, nov.

Type *P. parvus* Say.

(*Incerte sedis.*)

? Section HETERODISCUS Westerlund.

Heterodiscus WESTERLUND, Rad. Jugoslav. Akad. (Acta Acad. Sci. Slav. Merid.), CLI, p. 120, Zoöl. Rec., XL, 1903, Moll., p. 63. Type *Planorbis libanicus* Westerlund. Not *Heterodiscus* Sharp, Insecta, 1886.
? = Planorbina HALDEMAN, 1842, q. v.

The genus *Planorbis* is frequently ascribed to Guettard or Geoffroy, neither of whom accepted (in the papers where this name appears) the Linnean nomenclature. If we are to cite non-Linnean authors we must go back much further, for Petiver used the name in 1702 for a species which Linné afterward named *Helix spirorbis*. Another non-Linnean name is *Coretus* of Adanson, which he applied to a minute species an eighth of an inch in greatest diameter. Gray in 1847, by some error cites *Planorbis corneus* as Adanson's type, which

is, of course, absurd. The first author to introduce *Planorbis* to binomial literature was O. F. Müller, but as he used it, it was applicable to all aquatic Pulmonates with filiform tentacles, thus including *Physa*. Cuvier in 1798 cited three species, of which *P. corneus* was the first and *P. cornu-arietis* the second. In 1799 Lamarck cited the second species, and repeated this citation in 1801. But *P. cornu-arietis*, of which the soft parts and operculum were then unknown, does not agree with Lamarck's diagnosis and cannot be accepted as a type of the genus *Planorbis*. Draparnaud names no types, and only in 1810 does Montfort establish definitely the type of the genus as *P. corneus*. Subsequent selection of other types by later authors is, of course, of no effect. *Anisus* Studer was an exact synonym of *Planorbis* Müller, not Montfort, but Fitzinger, in 1833, made an effort to retain the name for a section of the true Planorbes. It is probable, however, that the name, which was intended to comprise two older genera already named, should be entirely eliminated from accepted nomenclature, as a gross violation of the rules. At any rate the name was used for a beetle by Dujardin in 1821, and no subsequent use of it is advisable for Mollusks.

Little is known of the anatomical characteristics of the various species, but much similarity is noted among those for which data are available. As to the shells, a wide variation is observable in form and sculpture, though as usual the peripheral species grade toward each other in the several groups. The great majority of the species present the peculiarity of the whorls rising above the original apex, which becomes basal, the shell (apparently sinistral) thus becoming what has been called ultra-dextral. The most obvious characters of the latter may be contrasted as follows:

Subgenus *Planorbis* s. s. Shell discoid, ultra-dextral, large, with a moderate number of gradually enlarging whorls rounded above and below; the aperture slightly and gradually expanded, with its margin simple and sharp. Type *P. corneus* Müller.

Section *Planorbina* Haldemann. Shell like *Planorbis* s. s. but vertically compressed, with smaller and more numerous whorls and a very oblique aperture. Type *P. olivaceus* Spix.

Subgenus *Helisoma* Swainson. Shell of moderate size, few whorled, the whorls carinate above and below and rapidly enlarging; spire and base funicular, aperture suddenly expanded, with a thickened peritreme. Type *P. bicarinatus* (Say) Sowerby.

There is no doubt that Sowerby's and Say's species are identical. I am unable to find distinctive characters in figures or diagnoses which

would differentiate *Taphius* Adams from *Helisoma*; and *Anisopsis* Sandberger, from the Jura, is very similar, though the aperture is not preserved in the fossils and may have been simple.

Section *Pierosoma* Dall Shell large, high, with few transversely sculptured whorls; the early whorls carinate and flattened above, funicular below; in the adult the flattened apex is usually depressed below the upper level of the ultimate whorl; the aperture is suddenly expanded and thickened. Type *P. trivolvis* Say.

Section *Planorbella* Haldeman. Like *Helisoma* but smaller, with more numerous whorls, with the last whorl strongly constricted behind a campanulate aperture; a flattish or even slightly convex upper surface; the base funicular. Type *P. campanulatus* Say.

The *P. multivolvis* Case differs from the type of *Planorbella* chiefly by its more numerous and closely coiled early whorls. In both a second year's growth shows a varix due to the retention of the aperture of the preceding year. Two preoccupied names were applied to *P. multivolvis* by Adams, but a study of specimens leads to the conclusion that its separation is unwarranted.

Subgenus *Tropidiscus* Stein. Shell depressed, the adult periphery angular or carinate, the aperture oblique, slightly expanded, simple. Type *P. umbilicatus* Müller (+ *P. complanatus* Stein).

Section *Tropidiscus* s. s. Shell moderately large and with comparatively few rapidly increasing whorls of which the junior portions are not keeled. Type *P. umbilicatus* Müller.

This subgenus was called '*Gyrorbis* Agassiz,' by Moquin Tandon, but Agassiz never proposed any such genus or group, the name *Gyrorbis* having been applied to a subdivision of *Valvata* by Fitzinger. Moquin Tandon's error was copied by Gray, and later by Westerlund, who, still later, having become aware that Fitzinger's name existed, proposed for the group already named by Stein, the name *Diplodiscus;* which naturally becomes a synonym of *Tropidiscus* Stein. Nevertheless, since Westerlund arranged his really typical '*Gyrorbis*' under *Tropidiscus*, and grouped under his new name the species of which *P. vortex* is an example (though without mentioning any type) and gave a suitable diagnosis, it may not be stretching the rules of nomenclature too far to retain his name for the following section.

Section *Diplodiscus* Westerlund (restricted). Shell small, with numerous slowly enlarging whorls keeled or angulate from the beginning. Type *P. vortex* Linné.

Section *Paraspira* Dall, nov. Shell resembling *Diplodiscus*, but with the whorls rounded throughout, and the aperture simple, hardly expanded. Type *P. rotundatus* Poiret.

Subgenus *Hippeutis* Agassiz. Shell small, lenticular, with a small number of rapidly increasing whorls, the last enveloping a large part of the preceding whorl; apex slightly depressed, base with a narrow umbilicus, aperture oblique, with a thin sharp margin. Type *P. fontanus* Lightfoot, European.

Section *Drepanotrema* Crosse and Fischer. Shell resembling *Hippeutis*, but less depressed, the whorls with a rounded periphery widest at the base, giving a domelike profile, umbilicus variable, from narrow to very wide. Type *P. yzabalensis* C. and F.

This group occurs in the Antilles, Mexico, Central and South America, where it represents the Palearctic *Hippeutis*.

Section *Menetus* H. and A. Adams. Like *Hippeutis*, but the last whorl not enveloping the preceding whorls to any marked extent. Type *Planorbis opercularis* Gould.

Section *Bathyomphalus* Agassiz. Shell like *Drepanotrema*, but with numerous closely coiled whorls, a flattish summit with the periphery nearer to it than to the base, the umbilicus moderate, exposing less of the coil than the summit shows. Type *P. contortus* Drap.

Subgenus *Gyraulus* Agassiz. Shell small, flattish, with few, rapidly increasing whorls, fully exposed above and below, with a nearly median periphery, spirally striate and hispid; aperture simple, sharp-edged, oblique. Type *Planorbis albus* Müller.

Section *Torquis* Dall, *nov. sect.* Like *Gyraulus* s. s. but with more rounded, less rapidly increasing whorls, not hispid or spirally striate, the aperture expanded and slightly thickened in the adult. Type *P. parvus* Say.

Section *Armiger* Hartmann. Shell small, with few, rapidly increasing, costate whorls, the costæ projecting at the periphery; the form in a general way like *Gyraulus*.

A discussion of the species follows.

* **Planorbis (Planorbina) glabratus** Say.

Planorbis glabratus SAY, Journ. Acad. Nat. Sci., I, p. 280, 1818 (South Carolina).

Planorbis lentus SAY, Am. Conch., VI, pl. IV, fig. I, 1834 (New Orleans).

This species is by no means always polished, and on a dull specimen of it I believe the later *P. lentus* Say to have been founded, though the latter name has been widely misapplied to senile specimens

of *trivolvis* such as occur in the north and east, if not throughout the range of the latter.

Planorbis (Helisoma) bicarinatus Say.

Planorbis bicarinatus SAY, Nicholson's Encycl., 1st ed., vol. II (no pagination), No. 2, pl. I, fig. 4, 1817 (Lake Erie); not of Lamarck, 1822. — BINNEY, Land and Fw. Sh. N. Am., II, p. 123, fig. 205, 1865.
Helix engonata RACKETT, 1822; + *Planorbis engonatus* CONRAD, 1834.

Range. — The United States east of the Rocky Mountains; eastern Canada.

Lake Superior to Lake Winnipeg! Lake Manitoba; Moose Factory, Hudson Bay! the lower Saskatchewan River at Grand Rapids! Knee Lake, Keewatin! Portland, Oregon! Yaqui River, W. Mexico!

FIG. 64. *Planorbis bicarinatus* Say.

This well defined species has probably been carried down stream from the sources of the Columbia River, in the same manner as some other east American species. It cannot be regarded as permanently established on the Pacific slope, as yet. It varies considerably in size, and for exceptionally developed specimens from Benzie Co., Mich., Walker has proposed the varietal name *major*.

Planorbis (Pierosoma) corpulentus Say.

Planorbis corpulentus SAY, Long's Exp., II, p. 262, pl. XV, fig. 9, 1824 (not of Binney *et al.*) — BRYANT WALKER, Nautilus, XIII, No. 12, April, 1900, pp. 133–138.

FIG. 65. *Planorbis corpulentus* Say. ½.

Range. —Northern Ontario from Lake Simcoe to Rainy Lake, Lake of the Woods, Winnipeg River and Lake! to Vermilion Lake, Lat. 56° 30′, in Athabaska.

Knee Lake, Keewatin! Isle à Lacrosse Lake! and English River! Rat Portage; northern Michigan and Minnesota.

This well marked species was unknown to Binney, and has been united mistakenly with *trivolvis* and others. It belongs to the colder northeastern portion of the continent and its complete range is yet unknown. It has not been identified from the region west of the Rockies. Mr. Walker's note on this species may be consulted with profit.

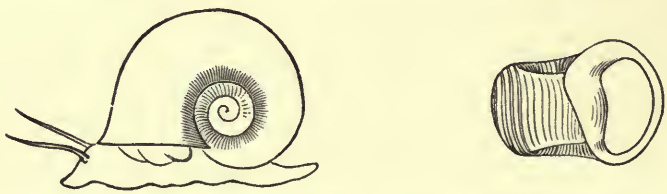
Planorbis (Pierosoma) binneyi Tryon.

Planorbis binneyi TRYON, Am. Journ. Conch., III, p. 197, 1867.— HALDEMAN, Mon. Limn., 19, pl. III, figs. 7–9, 1844.—BINNEY, Land and Fw. Sh. N. Am., II, p. 103, fig. 175, 1865.

Range.— West of the Rockies and east of the Cascade Mountains on the Pacific slope.

Oregon (Nuttall); Lewis or Snake River, Oregon! Clear Lake, Calif.! In British Columbia in eastern Kootenai Lake, Lake Siniakwateen, and Osoyoos Lake!

As pointed out by Binney, this is quite distinguishable from any form of *trivolvis;* it differs from the true *corpulentus*, with which it was long confounded, in its sparser and less regular axial sculpture, larger and less campanulate aperture, and in the greater distance of the carina from the axis. Its whorls increase more rapidly than in *P. traskii* Lea, or even *P. ammon* Gould,[1] and its sculpture is markedly coarser and less regular than in either of the two last cited. It is not known north of British Columbia or east of the Rocky Mountains.



FIGS. 66, 67. *Planorbis binneyi*, showing animal and shell.

Planorbis (Pierosoma) trivolvis Say.

Planorbis trivolvis SAY, Nicholson's Encyc., 1st ed., II (no pagination), pl. II, fig. 2, 1817; Am. Conch., VI, pl. 54, fig. 2, 1834 (French Creek, Lake Erie).

Planorbis macrostomus WHITEAVES, 1863 (abnormal); + *P. lentus* Gould, and many other writers, but not of Say; + *P. tumens* various California writers.

Planorbis subcrenatus CARPENTER, P. Z. S., 1856, p. 220.

Range. — The typical form belongs to the entire Atlantic drainage of North America and the Mississippi Valley and northward to the Etchimamish River.

English River, Keewatin; Lake Winnipeg, Manitoba; Cypress Hills! Assiniboia; Prairie Lake, Red River of the North!; the Saskatchewan River, Laggan, Egg Lake, Red Deer, McLeod, and Olds, Alberta; Lake Isle Lacrosse, Athabaska; Great Slave Lake, at Fort Resolution! and the Mackenzie River at old Fort Simp-

[1] These two species, judged by their types, which are before me, are sufficiently distinct from any of those which have been confounded with them. Indeed the true *P. traskii* from Kern Lake, Calif., is one of the most remarkable species in our fauna. It was also found by me at Stockton, Calif., and seems to have been unknown, autoptically, to Binney.

son! (N. Lat. 62°). We have it from Moose Factory! the Slave River 25 miles below Peace River! Lake Winnipeg! the Grand Rapids of the Saskatchewan River! and hundreds of more southern localities.

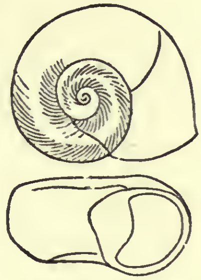


FIG. 68. *Planorbis trivolvis.*

The variety *subcrenatus* Carpenter (Oregon, Nuttall) occurs in British Columbia west of the Cascades; being, according to J. K. Lord, replaced east of them by *P. binneyi.* We have it from the Puget Sound drainage! Lake La Hoche! and Sumas Lake, B. C.! A distorted variety (*disjectus* Cooper) is reported from Lake Tahoe, Calif., at a height of 6,247 feet above the sea. The young shell was described from Pueblo Valley, Oregon, by Tryon in 1865, as *P. oregonensis.* In 1870 Cooper called the more common adult (but not senile) form *P. occidentalis*, and later confounded it with the Mexican *P. tumens* Cpr., and gave it a range in California from Kern Lake, Tulare Co., north to Puget Sound, and, in the coast drainage, to San Francisco Bay. There is a doubt as to whether *Planorbis hornii*

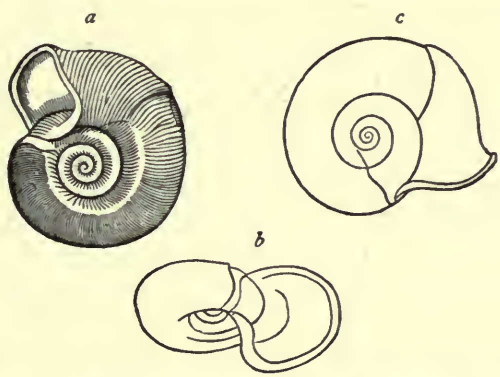


FIG. 69. *Planorbis trivolvis* var. *macrostomus* Whiteaves.

Tryon (1865), from "Fort Simpson, British America," came from Fort Simpson on the Mackenzie River, or Fort Simpson, British Columbia; but the figure looks more like the Pacific variety, of which it is probably only a mutation. We have specimens from various places in California, and Wallawalla, Wash., labelled *P. hornii* which are merely a depauperate form of *subcrenatus.*

On the other hand, from the Dall River, a northern affluent of the Yukon in Alaska, in N. Lat. 66°, we have the typical form of *trivolvis*

stretching westward with the Yukon drainage! I have never seen any specimens corresponding exactly to Tryon's figure of *P. hornii*, but the variations I have seen of *P. subcrenatus* often approach it so closely that I have little doubt of their identity. *P. macrostomus* seems, from an examination of the types, to be a form of *trivolvis* which has survived a year longer than usual, in a locality where it was not stinted in lime, resulting in a remarkably fine shell with richly colored aperture.

Planorbis (Planorbella) campanulatus Say.

Planorbis campanulatus SAY, Journ. Acad. Nat. Sci. Phila., II, p. 166, Jan., 1821 (Cayuga Lake, N. Y.). — HALDEMAN, Mon. Limn., p. 9, pl. 1, figs. 7–11, 1844.

Planorbis bellus LEA, 1844 (immature shell) + *P. complanatus* Miller Christy, 1885.

Range. — The type: New England to Tennessee, Florida and northward; Anticosti Island! Lake Superior to the Saskatchewan; L. Winnipeg, Red River of the North, Nelson and English Rivers; Moose Factory! Great Slave Lake, N. Lat. 62°; Lake of the Woods!

FIG. 70. *Planorbis campanulatus* Say.

Variety *rudentis*: Knee Lake, Hayes River, Keewatin, N. Lat. 55° (E. A. Preble)!

This well known species is confined to the Atlantic, Mackenzie, and Hudson Bay watersheds, and has not been reported north of Great Slave Lake. So far as the specimens examined go to show, it is rather remarkably uniform in its characters, the number of whorls remaining always about the same, though the actual size varies with the food supply and healthfulness of the environment.

A form which may prove distinct, or a variety of this species, was collected by Mr. Preble at Knee Lake. The comparative measurements are:

	Whorls.	Major Diam.	Minor Diam.	Axis.
Type.	4.75	15.0 mm.	11 mm.	6.5 mm.
Variety.	5.25	17.5	14	6.0

Very similar specimens were obtained from Anticosti Island and from Marl Lake, Michigan, in which the coil is even more irregularly wound, a condition I take to be pathological. The most noticeable difference, after the axially shorter whorls and larger size, is in the umbilicus, which in the variety is, as it were, reamed out, exhibiting three and a half whorls; while in the more compact type the umbilicus when examined with a lens shows only two and a half whorls, which

diminish in size much more rapidly than in the variety. The campanulate aperture is about the same size in both forms, but seems larger in the type because the rest of the shell is so much more tightly wound. The suture on the apical side seems deeper and wider than in the type. Nine specimens of the variety were obtained, and I suggest for it the name *rudentis*, from the similarity of the whorls to a coiled hawser.

Planorbis (Menetus) exacuous Say.

Planorbis exacuous SAY, Journ. Acad. Nat. Sci. Phila., II, p. 168, Jan., 1821 (Lake Champlain); Long's Exp. Rep., II, p. 261, 1824.
Planorbis exacutus GOULD, Inv. Mass., p. 208, fig. 137, 1841. — HALDEMAN, Mon. Limn., p. 21, pl. IV, figs. 1–3, 1844.
Paludina hyalina LEA, 1839 (scalariform monstrosity).

Range. — Northern United States, east of the Rockies; Canada, etc., south to New Mexico.

Lake Superior to Lake Winnipeg! Manitoba generally; Moose Factory, Hudson Bay! Left bank of the Yukon below Fort Yukon, Alaska, in Pleistocene marl (A. J. Collier)!

Variety *megas* Dall, *nov.*: Birtle, Manitoba (R. M. Christy).

This species has a number of varieties both in size and form. The typical shell is of a pale brownish horn color, with a somewhat glistening surface, rather rudely striated by the incremental lines, and with faint, almost microscopic, revolving striæ. The form is lenticular, coming to an acute angle at the periphery. In 1863 I found in the vicinity of Marquette, Michigan, an unusually depressed brownish variety in which the peripheral keel was delicately serrate. In the northwestern part of its range the tendency is for the species to become whitish and of a larger size than the average New York or New England specimens. This reaches its maximum in specimens collected in Manitoba by Mr. R. Miller Christy, for which I propose the varietal name *megas*. The comparative measurements are as follows:

	Whorls.	Max. Diam.	Min. Diam.	Axis.
Type.	3.33	4.7 mm.	3.7 mm.	1.0 mm.
Variety.	3.75	7.8	6.0	2.0

The variety is of a slightly milky translucency; on the base the whorl is more or less impressed within the peripheral keel and the spiral striation is much more marked than in the typical form.

Binney has united with this species *Planorbis lens* Lea, 1839 (not Brongniart, 1810) = *P. lenticularis* Lea, 1844 (not Schlotheim, 1818) = *P. brongniartiana* Lea, 1842; but an examination of Lea's

cotypes, now in the National Museum, makes it evident that Dr. Gould was right in referring this form to *P. dilatatus* Gould, 1841 (not Pfeiffer, 1841[1]), or *dilatus* Haldeman, 1844. To this latter form, in my opinion, should be united, as local races, *P. buchanensis* Lea, 1844, and *P. alabamensis* Pilsbry. The young of *P. exacuous* Say frequently approach *dilatatus*, but the latter can usually be distinguished by its axial height being greater, its columella more vertical, and the substance of the shell, especially in southern specimens, more thick and solid. The aperture of the adult *dilatatus* is usually distinctly thickened by a deposit of callus, but in *exacuous* I have never observed more than a very thin wash of shelly matter around the opening. I have spelled the name of this species as Say did in two separate works; as he gave no derivation it seems to me we have no right to correct his spelling on purely theoretical grounds.

Planorbis (Menetus) opercularis Gould.

Planorbis opercularis Gould, Proc. Boston Soc. N. Hist., II, p. 212, 1847; Moll. U. S. Expl. Exp., p. 113, Atlas, figs. 132, 132, *a–b*, 1852 (Sacramento River, Calif.).

Planorbis planulatus Cooper, Rep. Nat. Hist. Wash. Terr., p. 378, 1859; Pacific R. R. Rep., XII, p. 378.— Binney, Land and Fw. Shells N. Am., pt. II, p. 126, fig. 209, 1865.

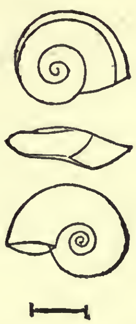


Fig. 71. *Planorbis opercularis* Gould (typical).

Planorbis centervillensis Tryon, Mon. Fr. Univ. Moll. U.S., p. 57, *Planorbis*, pl. VII, figs. 7–9, 1872.

Planorbis opercularis var. *oregonensis* Vanatta, Nautilus, IX, p. 53, Sept., 1895; not *P. oregonensis* Tryon, 1865.

Planorbis callioglyptus Vanatta, Nautilus, IX, p. 54, 1895.

Range.—San Francisco and northward, west of the Sierra Nevada.

Type form: California! Oregon! Washington near Seattle!

Variety *planulatus* W. Cooper: Whidbey Island, Puget Sound! Shawnigan Lake, Vancouver Island! Seattle, Wash.! Freeport, Wash.! Victoria, B. C.! Campbell's Creek, B. C.! Pender Island, B. C.! Atka Island, Aleutians, Alaska, near Korovin Bay!

Variety *centervillensis* Tryon: Alameda, Calif.! Noyo River, Calif.! San Leandro, Calif.! Oregon; Unalaska Island, Alaska!

Variety *oregonensis* Vanatta: Salem and Portland, Oregon!

[1] I learn through Prof. von Martens that Pfeiffer's species was published in the double part V–VI, of the Archiv für Naturgeschichte, either in the last part of 1841 or the early portion of 1842, so that Gould's priority is certain.

This species is the analogue of *P. exacuous* Say on the Pacific Coast. The typical form from the Sacramento River and the vicinity of San Francisco Bay is quite lenticular, with the periphery marked by a (frequently marginated) keel. The shell itself is pale yellow or white under a rather strong periostracum, which is almost invariably more or less discolored by deposits of a brown or black color. The sculpture is like that of *exacuous*, the spiral sculpture being faint and sometimes absent in southern specimens, and tending to be emphasized in northern ones. As a rule the margin of the aperture is not thickened except in young specimens which have been overtaken by drought or winter before maturity. The keel is generally, but not always, present in southern shells, but those from Oregon and northward show a tendency to form a shell either without a noticeable keel, or with the keel forming a margin to a plane upper surface, rather than a median carina. When compared with Cooper's types in the National Museum Mr. Vanatta's *P. callioglyptus* is seen to be identical. The variety *oregonensis* retains the typical form but has stronger spiral sculpture. I regard *P. centervillensis* of Tryon as a *P. planulatus* with the keel obsolete. What appear to be intergradational forms are numerous in the large series of the National Museum; though it would seem incredible to any one possessing only the extremes that they can belong to the same species.

FIG. 72. *Planorbis opercularis* var. *planulatus* Cooper.

Planorbis (Gyraulus) hirsutus Gould.

? Planorbis albus MÜLLER, Verm. Terr. et Fluv., II, p. 164, 1774.
Planorbis hirsutus GOULD, Am. Journ. Sci., XXXVIII, p. 196, 1840; Inv. Mass., p. 206, pl. XI, fig. 135, 1841.
Planorbis borealis (LOVÈN) WESTERLUND, Mal. Bl., XXII, p. 77, 1875.

FIG. 73. *Planorbis hirsutus* Gould. $\frac{4}{1}$.

Range. — Washington, D. C.! northward, east of the Mississippi. Lake Superior! Lake of the Woods! Lake Winnipeg and the Saskatchewan River! Great Slave Lake!

Var. *borealis* Westerlund: Port Clarence, Alaska. Northern Sweden.

This species appears to be common only in New England, if one may trust reports, and it is remarkable how few records there are of it in the literature of American fresh water shells.

The shell is variable in form; from having, in what I have regarded as the type, well rounded nearly cylindrical whorls, it varies to a form more or less depressed and carinate and with an oblique aper-

ture, which, when it has lost its hispid periostracum, can hardly be distinguished from the shell which is usually called *deflectus* of Say. This latter form, which, when in perfect condition, is fully as hairy as the typical *hirsutus*, is apparently identical with the shell which European writers catalogue under the name *draparnaudi* or *draparnaldi* of Sheppard. In its best state this has a peripheral fringe of longer hairs than those elsewhere on the surface, beneath which is usually, but not always, a faint peripheral keel like that of *P. deflectus* Say, which is distinguishable, so far as the shell is concerned, only by its less profuse and hairy periostracum. I should not be at all surprised if the two were eventually shown to be extremes of one specific form, especially as I have been unable to find specimens of typical *deflectus* which do not somewhere exhibit traces of spiral striation like that of *P. hirsutus*. The identity of our American species with the so-called *P. albus* Müller, of Europe, I do not doubt, but whether the name *albus* is the proper one to use for the latter is open to question, and on the present occasion I prefer to use a name about whose application no doubt can exist. The differences which have been reported to exist between the New England and the European shell are due to the comparison being made between discrepant varieties. If a series including all varieties from many different localities in Europe, be compared with a similar American series, parallels for each variation will be found.

Planorbis borealis (Lovèn MS.) Westerlund, after specimens furnished by Westerlund, is merely a somewhat delicately sculptured mutation of this species.

Planorbis (Gyraulus) deflectus Say.

Planorbis deflectus SAY, Long's Exp. Rep., II, p. 261, pl. XV, fig. 8, 1824. — HALDEMAN, Mon. Limn., p. 25, pl. IV, figs. 4–7, 1844 (N. W. Territory).

FIG. 74. *Planorbis deflectus* Say, $\frac{4}{1}$.

Planorbis virens ADAMS, 1840; young shell.

Planorbis obliquus DE KAY, 1843.

Range.—In America the same as that of *P. hirsutus*.

Ottawa, Canada! Lake of the Woods! Great Slave Lake! Dall River, Alaska, Lat. 66° N.! Popof Island, Shumagins, Alaska (Kincaid)!

Doubtfully distinct from the preceding species. It differs chiefly from the variety *draparnaudi* by the feebleness or absence of the hispidity of the periostracum. The deflection of the aperture and the consequent form of the mouth of the shell are inconstant characters,

although they have been called 'characteristic' by the very authors whose evidence shows the inconstancy.

Planorbis (Torquis) parvus Say.

Planorbis parvus SAY, Nicholson's Enc., 1st ed., II (no pagination), pl. 1, fig. 5, 1817.—HALDEMAN, Mon. Limn., p. 27, pl. IV, figs. 19–23, 1844 (Delaware R.)—BINNEY, Land and Fw. Sh. N. Am., II, p. 133, figs. 222–223 (not 224), 1865.
Planorbis concavus ANTHONY, MS., various catalogues.
Planorbis elevatus C. B. ADAMS, Bost. Journ. N. Hist., III, p. 327, pl. III, fig. 16, 1840; young shell (S. Boston).
Planorbis billingsi LEA, 1866, from types (Ottawa, Canada).

Range. — In America, the whole of eastern North America from Florida to N. Lat. 67°, and the Yukon drainage system.

Ottawa, Canada! northward and westward to Lake Winnipeg! the Saskatchewan River! Alberta at Laggan, Olds and McLeod; Manitoba at Brandon and Birtle! Methy Lake; Moose Factory! Fort Simpson, Mackenzie River! Lake Bennett, Yukon Territory! Left bank of the Yukon below Fort Yukon, Alaska!

The most striking characteristic of this widespread species is its 'reamed out' umbilicus. *P. limophilus* Westerlund, its nearest European analogue, may be distinguished at once by its shallow and flattish umbilicus. It rarely shows any trace of spiral sculpture and, when clean, is brightly polished. In the last whorl of the adult the portion above the periphery is usually somewhat flattened or obliquely depressed.

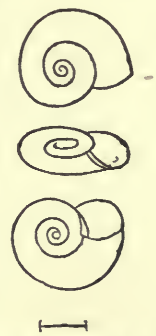


FIG. 75. *Planorbis vermicularis* Gld. (magnified).

Planorbis (Torquis) vermicularis Gould.

Planorbis vermicularis GOULD, Proc. Boston Soc. N. Hist., II, p. 212, 1847; Moll. U. S. Expl. Exp., p. 112, pl., figs. 131, *a–b*, 1852 (Oregon).

Range.—Northern California! Oregon! and Vancouver Island, British Columbia!

On comparison, the type of *P. vermicularis* is seen to have vertically deeper whorls than a specimen of *P. parvus* of the same number and diameter. The aperture is more expanded, and much larger, as one would expect from the greater lumen of the whorl. Specimens from middle and southern California have a different aspect and may prove on more careful study to belong to *P. parvus*. They certainly do not agree with the Oregon shell, which, however, I have seen from Noyo, California.

Planorbis (Torquis) nathorsti Westerlund.

Planorbis nathorsti WESTERLUND, Vega Expd., IV, p. 168, 1887. — POSSELT, Consp. Fauna Grönl. Moll., p. 162, 1898.

Aulatsivik, West Greenland (Sofia Expedition); Labrador (Storer).

This species is said to approach *P. arcticus*, but has four and a half turns in a diameter of 3.5 mm., while the latter turns only three and a half times in 5.0 mm. *P. nathorsti* has spiral as well as transverse striation. It has not been figured.

Some specimens in the National Museum collected in Labrador exhibit about four turns in 3.5 mm. diameter, according to my calculation, but so much personal equation enters into the estimation of the extent of the first whorl that I am inclined to think they belong to Westerlund's species, in which case it is intermediate between *parvus* and *arcticus*, but without the excavated umbilicus of the former.

Planorbis (Torquis) arcticus Möller.

Planorbis arcticus (BECK, MS.) MÖLLER, Index Moll. Grönl., p. 5, 1842.— MÖRCH, Am. Journ. Conch., IV, p. 32, pl. IV, fig. 9, 1868.—MÖRCH, in Rink's Danish Greenland, p. 436, 1877.

Range. — West Greenland! Fort Chimo, Ungava, Labrador!

Species with larger whorls, the last more expanded near the aperture, and with the sides of the umbilicus not excavated as in *P. parvus* Say.

Planorbis (Torquis) umbilicatellus Cockerell.

Planorbis umbilicatus TAYLOR, Journ. Conch., IV, p. 351, 1885; not of Müller, 1774. Manitoba.
Planorbis umbilicatellus COCKERELL, Conch. Exch., II, p. 68, Nov., 1887.— VANATTA, Nautilus, IX, No. 10, p. 117, 1896.

Range. — From Mesilla, New Mexico! northward, through Colorado, Montana, Iowa, Minnesota, to Manitoba.

Rapid City, Birtle, Brandon! in Manitoba; McLeod, Red Deer, Olds, Laggan, in Alberta.

Planorbis (Armiger) crista Linné.

Nautilus crista LINNÉ, Syst. Nat., ed. X, p. 709, 1758.
Turbo nautileus LINNÉ, Syst. Nat., ed. XII, p. 1241, 1767.
Planorbis imbricatus MÜLLER, Hist. Verm. Terr., II, p. 165, 1774.
Planorbis cristatus DRAPARNAUD, Hist., p. 44, pl. II, figs. 1–3, 1805.
Planorbis nautileus GRAY, Turton's Man. Land and Fw. Shells, p. 236, pl. VIII, fig. 94, 1857.
Planorbis costatus DE TAR and BEECHER, leaflet of one page, Albany, Oct. 25, 1878.
Planorbis crista WOODWARD, Brit. Nonmarine Moll., in Journ. Conch., X, p. 355, 1903.

Range. — Europe, Algeria, in the Old World; in America at Caribou, Aroostook Co., Maine! Hamilton and Ottawa, Canada; Ann Arbor, Michigan! Red Deer in Alberta; Manitoba.

This small and inconspicuous species will doubtless be found in many other localities when thorough search is made.

Genus Segmentina Fleming.

Segmentina FLEMING (1817, Edin. Encycl., ed. VII, vol. XII, *fide* Turton Manual, p. 116, 1831); Brit. An., p. 279, 1828. Type *Nautilus lacustris* (Lightfoot) Montagu. — HALDEMAN, Mon. Limn., IV, p. 14, 1842.— STEIN, Schnecken u. Musch. Berlins, p. 78, 1850. — WESTERLUND, Fauna Pal. Reg., V, p. 85, 1885. — WOODWARD, List. Brit. Nonmarine Moll., p. 355, 1903.

Hemithalamus LEACH (1819), Proofsheets, p. 137, *fide* Turton, Manual, p. 116, 1831. — FITZINGER, Syst. Verz., p. 110, 1833. — RÖSSMÄSSLER, Icon., I, pt. II, p. 15, 1835.—*H. nitidus* (MÜLLER) LEACH = *P. lineatus* Jeffreys.

Segmentaria SWAINSON, Malac., p. 337, 1840; *lapsus pro Segmentina* Fleming.

Hippeutis (sp.) AGASSIZ in Charpentier, Fauna Helvetica, p. 22, 1837. — HARTMANN, Syst. Uebers, tab., 1840.

Dentatus GRAY, P. Z. S., 1847, p. 181, not of Beck, 1837, *P. armatus* Gray; ? = *P. armigerus* Say + *P. armiger* Beck.

> *Planorbula* HALDEMAN, Mon. Limn., IV, p. 14, 1842, *P. armigerus* Say.

Discus HALDEMAN, Mon. Limn., I, p. 4 of cover, July, 1840 (*P. armigerus* Say), not of Fitzinger, 1883.

This genus was founded by Fleming on the *Planorbis nitidus* of Müller, of which *lacustris* Lightfoot, is a synonym. I have not been able to verify the reference to the Edinburgh Encyclopedia. Leach's name was circulated in proof sheets, but not actually published or cited by other authors until after Fleming's description appeared. Beck called a group of Planorbes '*Dentati*' but applied no name to the group, and the transformation by Gray to '*Dentatus*,' as if it had been intended for a generic or subgeneric name, seems quite unwarranted.

The genus may be divided into three groups as follows:

Subgenus *Segmentina* s. s. Base flattened, coil close, margin of the aperture simple, sharp; lamellæ ridgelike, several sets persistent in the adult. Type *P. nitidus* Müller. Palearctic region.

Subgenus *Planorbula* Haldeman. Whorls rounded, coil loose, margin of the aperture simple, sharp, slightly expanded; lamellæ dentiform, only one set persistent in the adult. Type, *P. armigerus* Say. Nearctic region.

Haldemanina Dall, n. sect., whorls carinate above and below, margin of aperture thickened and reflected; lamellæ complex, dentiform and ridgelike, one series persistent in the adult. Type, *Planorbis wheatleyi* Lea. Coosa drainage of Alabama.

The lamellation of *Segmentina* is composed of irregular undulate ridges, radiating from the axis of the shell. In *Planorbula* there are four dentiform lamellæ on the outer and two (one quite small) on the axial side of the throat, in a general way mostly turned in the direction of the coil, and the earlier series are absorbed as the animal grows. The position and shape of these lamellæ are remarkably uniform in all the species. In *Haldemanina* the lamellæ are more elongate and complex, requiring a diagram to define their relations, but on the whole more like *Planorbula* than *Segmentina*. (See Binney, Land and Fw. Sh. N. Am., II, p. 137, figs. 226–7, 1865.)

Segmentina (Planorbula) armigera Say.

Planorbis armigerus SAY, Journ. Acad. Nat. Sci. Phila., II, p. 164, 1818.—HALDEMAN, Mon. Limn., p. 30, pl. IV, figs. 11–13, 1844.—GOULD, Inv. Mass., p. 205, fig. 138, 1841. Type locality, Upper Missouri.
Planorbis armiger BECK, Index, p. 123, 1838.

Range. — New England and the Middle States, south to Georgia, westward to Nebraska, and northward to Great Slave Lake.

Lake Winnipeg and the Saskatchewan River! Egg Lake, Saskatchewan: Red Deer · Battle River; Great Playgreen Lake, Manitoba; Fort Ellice and Fort Pelly; Vermilion Lake; Moose Factory; James Bay! Fort Resolution, Great Slave Lake!

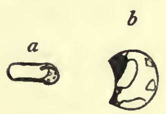


FIG. 76. *Planorbula armigera* Say. *a*, nat. size; *b*, teeth magnified.

FIG. 77. Teeth of *P. wheatleyi* Lea, for comparison.

Shell biconcave, of five whorls, polished, with an olivaceous periostracum; upper surface slightly concave in the center, the suture deep but not channelled, upper surface of the whorls with an obscure carination, the last part of the last whorl expanded and suddenly deflected downward, base with a steeply funicular umbilicus, exhibiting in scalar fashion all the whorls, and bordered by an obtuse carina; periphery of the whorls median, rounded; lip simple, hardly thickened, continued across the body by a thin callus; aperture at an angle of 45° to the vertical axis; surface sculptured by fine lines of growth and obsolete microscopic, inconstant, spiral striation. Max. diam. 8.0; min. diam. 6.5; height 3.0 mm.

This common species extends well to the north, but has not yet been reported from any part of the Pacific drainage, where it appears to be replaced by a very similar species, *P. declivis* Tate, which however has not yet been collected north of the Umpqua River, Oregon, specimens from that locality and from Nicaragua being in the National Museum.

Segmentina (Planorbula) christyi n. sp. Plate II, figs. 10, 11.

Shell resembling *P. armigera* in a general way but having six whorls, the upper surface nearly flat, the latter part of the last whorl in nearly the same plane as the preceding whorls, with no marked deflection; the whorls rounded, with no carina above or below; the surface sculptured with fine close silky incremental lines and fine sharp spiral striæ, giving a minutely reticulate effect when magnified; aperture-plane about 25° from the vertical; teeth very similar in form and position to those of *P. armigera*. Max. diam. 10.0; min. diam. 7.5; height 3.0 mm.

High Bluff, Manitoba! (R. Miller Christy); Fort Smith, Mackenzie River! (E. A. Preble).

After comparing these shells with a large series of *P. armigera* and finding nothing intermediate, I conclude that this form is worthy of a name. I have examined seven specimens of *P. christyi*, and several hundred from forty different localities, north and south, of *P. armigera*. The present form is the largest, flattest, and most sharply sculptured of the group.

Family PHYSIDÆ.

Genus **Physa** Draparnaud.

<*Physa* DRAPARNAUD, Tableau, pp. 31, 52, 1801; Hist. des Moll. de France, pp. 25, 28, 54, 1805; first species *Bulla fontinalis* Linné. — ROISSY, Moll., V, p. 343, 1805.— STUDER, Syst. Verz., p. 25, 1820.— LAMARCK, An. s. Vert., VI, pt. 2, p. 155, 1822. Not of Fitzinger, 1833, nor Westerlund, 1902.

Enydra HÜBNER, Zwei Briefe, 1810 (nomenclature non-Linnean?).

Physa SOWERBY, Genera, fasc. VII (*Limnæa*), 1822.— FLEMING, Brit. An. p. 276, 1828.— LEACH, Proofsheets, p. 150, *fide* Turton, Man., p. 127, 1831.— LEACH, Synops. Moll. Gt. Brit., p. 109, 1852.

Rivicola FITZINGER, Verz. Conch., p. 110, 1833. Type *B. fontinalis* Linné.

<*Physa* BINNEY, Land and Fw. Sh. N. Am., II, p. 75, 1865.— DALL, Ann. Lyc. N. H. N. Y., IX, p. 355, 1870. Type *P. fontinalis*.

Physella HALDEMAN, Mon. Limn., I, pp. 14, 38, 1842; type *P. globosa* Hald.— DALL, *op. cit.*, p. 355, 1870.

Physodon HALDEMAN, Mon. Limn., I, pp. 14, 39, 1842; type *P. microstoma* Hald. — DALL, *op. cit.*, p. 356, 1870.

? *Diastropha* GRAY, in Turton, Man., ed. II, p. 16, 1840; sole ex. *Physa contorta* Michaud.— HALDEMAN, Mon. Limn., III, 3d page of cover, 1841, text, pp. 14, 35, 1842. — MOQUIN TANDON, Hist. Moll. Fr., II, p. 450, 1855.

? *Diastropha* 'Guilding,' GRAY (Synops. Brit. Mus., 1840, *fide* Agassiz), P. Z. S., 1847, p. 180; *Physa guildingii* Swainson.

<*Phyza* RISSO, Hist. Nat. Eur. Mér., IV, p. 96, 1826; -st sp. *P. fontinalis* Drap.

>*Macrophysa* MEEK (MS. 1865), DALL, Ann. Lyc. N. H. N. Y., IX, p. 356, 1870; type *Physa columnaris* Deshayes, Eocene.

>*Costatella* DALL, Ann. Lyc. N. H. N. Y., ix, p. 355, 1870. Type *Physa costata* Newcomb.

>*Costella* MEEK, Inv. Fos. Upper Missouri, pp. 603–604, 1876; *lapsus pro Costatella.*

>*Macrophysa* TRYON, Struct. Syst. Conch., iii, p. 103, 1884.

Bulinus WESTERLUND, Fauna Pal. Reg., p. 54, 1885 (not of Adanson, 1757); Acta Acad. Sci. Slav. Merid., Zagrabiæ, cli, p. 119, 1902.

<*Bullinus* OKEN, Lehrb. d. Naturg., sp. x, 302–3, 1815. *B. fontinalis* L., first species.

This genus has suffered from its resemblance to the sinistral Lymnæas and the physiform Planorboids, which have been and still are frequently confounded with the true Physas. Not until much more is known of the dentition and soft parts will it be practicable to eliminate from *Physa* all the unrelated species. The group containing *Isidora*, *Physopsis*, etc., is chiefly South European and African, but it is probable that some of the subtropical American species also belong to it. The subgenus *Physella* Haldeman, was proposed because the author believed it to be branchiate instead of pulmonate, but we now know that undoubted species of *Lymnæa*, having no access to the atmosphere, live in the deep waters of some of the Swiss lakes, perhaps gathering up globules of oxygen freed by aquatic plants; and unless some more definite observations show anatomical distinctions (such as were merely surmised by Haldeman) the group is hardly worth retention. *Physodon* Haldeman, so far as the shell is concerned, differs from *Physa* s. s. only by an almost imperceptible thickening below the obscure plait on the pillar, and, in default of other characters, might well be dispensed with.

The soft parts of *Diastropha contorta* (Mich.) have not been described, and there is some reason to think it may be an *Isidora*. Gray, who first introduced it in connection with the above mentioned species, subsequently listed it as a name (MS.?) given by Guilding, and mentioned as type *Physa guildingi* Swainson, which is an *Aplexa*.

The groups into which the genus may confidently be divided are as follows:

Section *Physa* s. s. Shell sinistral, ovoid, polished, with a spire shorter than the length of the aperture, an obscure plait on the pillar, with the pillar merging gradually into the peristome, the outer lip sharp, often with a slight thickening internally, the inner lip closely appressed to the body and pillar, a very small or no umbilicus, the surface of the shell smooth or microscopically striated. Type *Bulla fontinalis* Linné. Holarctic and Temperate regions of both hemispheres, also Hawaii.

? Section *Macrophysa* Meek. Shell elongate, columnar, large, the last whorl and aperture small compared with that of the typical *Physa*, the surface axially striated. Type *Physa columnaris* Deshayes, Eocene of Paris Basin.

Section *Costatella* Dall. Shell physiform, polished, sculptured with axial ribs. Type *Physa costata* Newcomb.

The section *Macrophysa* has been affiliated to *Isidora* by Sandberger and others, but as the species is only known in the fossil state some doubt must remain as to its relations. It has somewhat the form of *Isidora wahlbergi* Krauss from South Africa, but the resemblance may be merely a parallelism and not an indication of relationship, as we find several species of *Isidora* absolutely indistinguishable from true *Physa* except by anatomical examination.

The groups known as *Ameria* Adams, *Glyptophysa* Crosse, *Plesiophysa* Crosse and Fischer, *Physopsis* Krauss, *Pulmobranchia* Pelseneer, etc., are more or less intimately connected with *Isidora* Ehrenberg (*Bulinus* Adanson) and do not form part of the family *Physidæ*. None of them occurs in the region to which this paper relates. I am indebted to the discussion of American Physæ by O. A. Crandall in the Nautilus, volume xv, for assistance in determining the species of *Physa* from the north.

Physa heterostropha Say.

Physa heterostropha SAY, Nicholson's Encycl., Am. ed. (no pagination), pl. I, fig. 6, 1817.— HALDEMAN, Mon. Limn., p. 23, pl. II, figs. 1–9, 1843. —BINNEY, Land and Fw. Sh. N. Am., II, p. 84, figs. 144–5, 1865.

Physa plicata DE KAY, *fragilis* Mighels, *lata* Tryon, *primeana* Tryon, and *philippii* Küster, are said to be synonymous by Crandall.

FIG. 78. *Physa heterostropha.*

Range. — From the Potomac and Ohio Rivers northward, and westward to the Mississippi.

Anticosti Island! Manitoba, Red River of the North, Lac des Mille Lacs to Lake of the Woods; Alberta, at Olds, McLeod and Red Deer. Grand Rapids of the Saskatchewan! L. Winnipeg! English River! Albany River! near James Bay; Hudson Bay drainage in Keewatin at Moose Factory! and Nelson River! Lake Isle Lacrosse! Peace River! and Great Slave Lake!

Readily recognizable by its form and the absence of microscopic spiral sculpture. The northern specimens, when dead, are of a beautiful opalescent white with a claret colored apex.

Physa gyrina Say.

Physa gyrina SAY, Journ. Acad. Nat. Sci. Phila., II, p. 171, 1821. — HALDEMAN, Mon. Limn., p. 32, pl. 3, figs. 1–6, 1843; Council Bluffs, Iowa.

Physa hildrethiana LEA, *oleacea* Tryon, and *albofilata* Ancey, are united by Crandall with this species.

Physa fontinalis J. DE C. SOWERBY (in Richardson), not of Linné.

Range.—The United States east of the Mississippi, Canada, and northward.

FIG. 79. *Physa gyrina* var. *hildrethiana* Lea.

Manitoba! Lower Saskatchewan near Lake Winnipeg! York Factory, Keewatin; Great Slave Lake! Methy Lake to Great Bear Lake (Richardson).

Variety *oleacea* Tryon, also variety *hildrethiana* Lea: Great Slave Lake; Port Clarence, Alaska (Bean).

This is the prevalent species over the north country, extending to the Arctic Circle at Great Bear Lake, and westward to Bering Strait. It is to be noted however that *Physa* in this region is nowhere a common form like *Lymnæa* or *Planorbis*, or even *Aplexa*. The varieties noted differ from one another and from the typical form chiefly in the character of slenderness.

Physa ancillaria Say.

Physa ancillaria SAY, Journ. Acad. Nat. Sci. Phila., v, p. 124, 1825. — HALDEMAN, Mon. Limn., p. 27, pl. III, figs. 1–10, 1843. — GOULD, Inv. Mass., p. 213, fig. 142, 1841. — CRANDALL, Nautilus, XV, No. 4, p. 42, 1901.

Physa vinosa GOULD, and *P. crassa* WALKER, are regarded as subspecies of *P. ancillaria* by Crandall, and Binney unites with it *P. obesa* De Kay.

Range. — The United States northward from the Potomac and Ohio Rivers, and east of the Mississippi, to the Saskatchewan. Variety *vinosa* Gould, Lake Superior.

Manitoba. Lake of the Woods; Lake Winnipeg; and the lower Saskatchewan River.

The above localities are cited from the literature; I have seen no specimens from north of the United States, west of Ontario.

Physa lordi Baird.

Physa lordi BAIRD, Proc. Zool. Soc. London, for 1863, p. 68. — BINNEY, Land and Fw. Sh. N. Am., II, p. 76, figs. 125–127.

Physa parkeri CURRIER, in Decamp, List of Shellbearing Moll. of Mich., Kent Sci. Inst. Misc. Pub., v, p. 15, pl. I, fig. 3, 1881.

Range. — Washington and British Columbia, east of the Cascade Mountains, eastward to the northern peninsula of Michigan, and southward at high altitudes to New Mexico.

FIG. 80. *Physa lordi* Baird.

Round Lake! Lake Houghton! and Lake Douglas! northern Michigan! Mingusville, Montana! Ft. Col-

ville, Wash.! Lake Osoyoos, Lat. 49° and Kootenai Lake, British Columbia; San Rafael, Valencia Co., New Mexico; altitude 6,000 feet!

I find this remarkable species in the National collection labelled *P. parkeri* Currier. There is a form very similar in miniature to this, which occurs in the Gila River, Arizona, and elsewhere in that region, but, while this may be a dwarf form of *P. lordi*, I do not feel sufficiently certain to include it in the range of the latter. The Michigan specimens however are typical, and finely developed, not in any way to be distinguished from those collected in Washington.

Physa propinqua Tryon.

Physa propinqua TRYON, Am. Journ. Conch., I, p. 223, pl. 23, fig. 5, 1865; Mon. Fw. Univ., Moll. U. S., pt. 3, p. 132, pl. VI, fig. 13, 1872.

Range. — Jordan Creek, SW. Idaho, west to Puget Sound and south to Los Angeles, Calif.

Puget Sound drainage! Sumas Prairie, Fraser River valley, British Columbia, and elsewhere in the lowlands of British Columbia, east of the Cascades.

This form closely resembles *P. heterostropha* Say, and is the shell which has been listed by that name from the Pacific Coast, where according to Tryon and Crandall the true *P. heterostropha* does not occur. Whether it is a distinct species, or a special mutation of *P. ampullacea* Gould, or a western race of some other species, I do not feel able to determine, and so I accept Tryon's assurance that it is a valid species.

Physa ampullacea Gould.

Physa bullata GOULD, Proc. Boston Soc. N. Hist., V, p. 128, 1855; not of Potiez et Michaud, 1838.
Physa ampullacea GOULD, in Binney, Land and Fw. Sh. N. Am., II, p. 79, figs. 134, 135 (not 133), 1865.

Range. — Oregon and Washington, northward to Norton Sound on the Pacific Coast.

Oregon! Lake Oyosa, Washington! Vancouver Island, near Victoria; ponds near St. Michael, Norton Sound, Alaska, rare!

A single specimen of what seems to be this species was found among other shells collected near St. Michael, Alaska, by E. W. Nelson.

Physa (Aplexa?) hordacea Lea.

Physa hordacea LEA, Proc. Acad. Nat. Sci. Phila., for 1864, p. 116; Journ. Acad. Nat. Sci. Phila., (2), VI, pp. 176, 177, pl. XXIV, fig. 102, 1866; Obs. Gen. Univ., XI, pp. 132–3, pl. XXIV, fig. 102, 1866.

Bulinus hordaceus TRYON, Mon. Fw. Univ. Moll. U. S., p. 170, pl. VII, fig. 19, 1872.

Range. — Oregon, Washington, Vancouver Island.

Fort Vancouver, Wash.! near Puget Sound, Wash.!

This is the small species, having much the appearance of an *Aplexa*, which has been cited on the authority of Dr. J. G. Cooper as *Aplexa hypnorum* from near Puget Sound. This error was afterward corrected by Cooper himself. No observations have been recorded in regard to the animal, and when these have been made it is entirely possible that the creature may turn out to be an *Aplexa*. It is entirely distinct from *A. hypnorum* at any rate

Genus **Aplexa** Fleming.

Bulla (sp.) LINNÉ, Syst. Nat., ed. X, p. 727, 1758.—GMELIN, Syst. Nat., VI, p. 3428, 1792.
Planorbis (sp.) O. T. MÜLLER, Hist. Verm., II, p. 169, 1774.
Turbo (sp.) WALKER, Test. Min. var., p. 15, 1787.
<*Bulinus* O. T. MÜLLER, in Der Naturforscher (Halle), XV, p. 6, 1781 (after Adanson, Sénégal, p. 5, 1757, non binomial).
<*Physa* DRAPARNAUD, Tableau, pp. 31, 52, 1801; Hist. des Moll. de France, p. 55, 1805.
<*Bulimus* POIRET, Coq. Fluv. et Terr., p. 41, 1801; not of Scopoli.
<*Bullinus* OKEN, Lehrb. d. Naturg., pp. x, 302, 1815.
Aplexa FLEMING, in Sowerby, Gen., fasc. VII, 1822; Hist. Brit. An., p. 276, 1828. Type *Bulla hypnorum* Linné, 1758.
<*Phyza* RISSO, Hist. Nat. Eur. Mér., IV, p. 96, 1826.
Nauta (LEACH, MS.) TURTON, Man., p. 129, 1831 (in syn.). — LEACH, Syn. Moll. Gt. Brit., p. 110, 1852.
< *Bulinus* BECK, Index Moll., p. 116, 1838; not *Bulinus* Beck, *op. cit.*, p. 117, nor Philippi, Handb. Conch., p. 255, 1853.
Physa FITZINGER, Syst. Verz., p. 110, 1833; not of Draparnaud.
Aplexus GRAY, Turton's Man., ed. II, p. 255, 1840.— SOWERBY, Man., ed. II, p. 70, 1842.— BROWN, Ill. Conch. Gt. Brit., p. 135, 1844.—CHENU, Man., I, p. 481, 1859.
Aplexa BECK, Index Moll., p. 116, 1838. — PHILIPPI, Handb. Conch., p. 255, 1853. — MÖRCH, Vidensk. Meddel., p. 308, 1864. — TRYON, Struct. Syst. Conch., III, p. 103, 1884.
Nauta BECK (in syn.), Ind. Moll., p. 166, 1838.
Amplexa BROWN, Ill. Conch. Gt. Brit., ed. II, p. 31, 1844 (err. type); not *Amplexus* Brown, *op. cit.*, p. 45.
Aplecta HERRMANNSEN, Ind. Gen. Mal., I, p. 65, 1846.—FISCHER, Manuel Conch., p. 511, 1883.
Myxas GRAY, Proc. Zool. Soc. for 1847, p. 180, not of Leach, 1822.
Bulinus BINNEY, Land and Fw. Sh. N. Am., II, p. 97, 1865.— DALL, Ann. Lyc. N. Hist. N. Y., IX, p. 356, 1870.
Nauta WESTERLUND, Fauna Pal. Reg., V, p. 57, 1885.

Shells of species allied to *Physa*, but usually more slender and elevated, the mantle not extending beyond the margin of the aperture and its edge entire, without filamentary appendages; jaw strongly

arcuated, thin, cartilaginous, without accessory plates; other characters as in *Physa.*

Type *Bulla hypnorum* Linné, 1758, Holarctic.

The nomenclature of this genus has been subject to some vicissitudes. In 1757 Adanson, who did not adopt the binomial nomenclature, described a minute shell from the fresh waters of Senegal under the name of "le Bulin, *Bulinus.*" From its form and size it was certainly not an *Aplexa*, but rather a species of the group called by Ehrenberg, in 1831, *Isidora.* This genus has the jaw and radula of a *Planorbis* and may be regarded as a physiform relation of the latter genus. To a considerable extent it replaces *Physa* in tropical Africa.

Scopoli in 1777 attempted to utilize Adanson's researches, and proposed a genus *Bulimus* in which he included *Limnæa*, *Succinea* and *Bythinia* (sp.), attributing the genus to Adanson and paraphrasing Adanson's diagnosis of the characters of the animal. The name was later used for the large land shells for which it is familiar, but to which the diagnosis cannot be applied.

It seems almost certain that *Bulimus* (Scopoli) is a misprint for *Bulinus* (Adanson), but, as usual, several authors have not hesitated to propose a bogus derivation for a name for which the author gave no derivation, and have ignored the statement of Adanson, who gives a legitimate and totally different source for the name.

However this may be, *Bulimus* long had currency in conchological nomenclature for animals with which we are not here concerned, and in 1781 Otho Friedrich Müller revived Adanson's name in its original form for the group named *Physa* by Draparnaud twenty years later. Müller included in his list of species Adanson's type (to which he gave the binomial name *Bulinus senegalensis*), *Bulinus turritus* (= *Aplexa hypnorum* L. sp.) and *Bulinus perla* (= *Physa fontinalis* Drap.).

Since he states that his genus is that of Adanson, it follows that Adanson's sole species must be taken as the type, which eliminates one of the three groups concerned. For the group represented by *Physa fontinalis* Draparnaud's name has been generally and properly retained, while the first available name for the third group is *Aplexa* Fleming. This is accepted and defined by Sowerby as indicated in the synonymy above given, but may have been used earlier in print by Fleming; though I have found no record of it if this be the case. Sowerby speaks of it as if it were not a manuscript name, but does not explicitly so state.

Later on Herrmannsen supplies a gratuitous derivation for Fleming's name and, because it does not properly conform to his imaginary source, alters the spelling to *Aplecta*.

This was totally unauthorized. Since no derivation was given by Sowerby, we are at liberty to regard the word as an arbitrary combination of letters formed on the analogy of *triplex* and similar Latin words, but we are not at liberty to manufacture an imaginary derivation and then force the name to conform to it.

Several authors divided Müller's group differently, and several synonyms were proposed for parts of it, as will be evident on a study of the synonymy.

The genus occurs in the Tertiary of Europe and North America, and possibly as far back as the Middle Cretaceous of North America. Several well characterized forms have been described from the Laramie. The type is known from the Palearctic and Nearctic regions, and the genus extends south to Mexico, where in the tropical conditions of Mazatlan perhaps the finest of the recent species occurs abundantly. In Alaska and on the adjacent continent of Asia but one species is known, the type.

Aplexa hypnorum (Linné).

Bulla hypnorum LINNÉ, Fauna Suecica, ed. I, No. 1303, 1746; ed. II, No. 2159, p. 522, 1761; Syst. Nat, ed. X, p. 727, 1758; ed. XII, p. 1185, 1767.

Bulimus hypnorum BRUGUIÈRE, Encycl. Mèth., p. 301, 1792.

Planorbis turritus MÜLLER, Verm. Terr., II, p. 169, 1774.

Physa hypnorum DRAPARNAUD, Hist., p. 55, pl. III, figs. 12–13, 1805. — HALDEMAN, Mon. Limn., p. 36, pl. V, figs. 4–9, 1842. — FORBES and HANLEY, Brit. Moll., IV, p. 143, pl. CXXII, figs. 6–7.

Bulla hypnorum MONTAGU, Test. Brit., II, p. 228, 1803.

Bulla turrita GMELIN, Syst. Nat., VI, p. 3428, No. 20, 1792.

Aplexa hypnorum SOWERBY, Genera, fasc. VII, 1822.— FLEMING, Hist. Brit. An., p. 276, 1828; Encycl. Brit., ed. VII, 1837; Art. Mollusca, reprinted as 'Molluscous Animals,' 8°, Edinburgh, p. 158, 1837.

Turbo stagnalis WALKER, Test. Min. Rar., p. 15, pl. II, fig. 54, 1787.

Nauta hypnorum (LEACH, in) TURTON, Man., p. 129, 1831. — LEACH, Syn. Moll. Gt. Brit., p. 110, 1852.

Physa hypnorum, Hist. des Moll., p. 55, pl. III, figs. 12, 13, 1805.—PFEIFFER, Naturg. Deutscher Land. Moll., I, p. 97, 1821.

Bullinus turritus OKEN, Lehrb. d. Naturg., p. 303, 1815.

Physa hypnorum LAMARCK, Anim. s. Vert., VI, pt. II, p. 157, 1822.

Physa elongata SAY, Journ. Acad. Nat. Sci. Phila., II, p. 171, 1821. — GOULD, Inv. Mass., p. 214, fig. 143, 1841. — DE KAY, Zool. N. Y. Moll., p. 81, pl. VI, fig. 346, 1843.

Physa turrita J. DE C. SOWERBY, in Richardson, Fauna Bor. Am., III, p. 315, 1836.

Physa glabra DE KAY, Zool. N. Y., Moll., p. 80, pl. V, fig. 83, 1843.

Physa elongatina LEWIS, Proc. Boston Soc. N. Hist., V, pp. 122, 298, 1855.
Aplexus hypnorum CHENU, Man. de Conch., I, p. 481, fig. 3556, 1859.
Bulinus hypnorum BINNEY, Land and Fw. Sh. N. Am., II, p. 99, fig. 170, 1865.
Bulinus hypnorum var. *picta* KRAUSE, Sitzb. Ges. Naturf. Fr. zu Berlin, 1883, p. 32. — MARTENS, Conch. Mitth., II, p. 184, 1885.
Physa hypnorum var. *polaris* WESTERLUND, Sib. l. u. Söttv. Moll., p. 56, 1877. — MARTENS, Conch. Mitth., II, p. 184, 1885.
Physa (*Nauta*) *hypnorum* LINNÉ. — WESTERLUND, Fauna Paläarct., Reg. V, p. 57, 1885.
Physa (*Nauta*) *hypnorum* var. *polaris* WESTERLUND, *op. cit.*, p. 58.

Range. — Northern Europe, Asia and America, Northern United States and Canada.

English River, Manitoba. Red Deer, McLeod, Olds, etc., in Alberta. Great Slave Lake, at Fort Resolution! York Factory, Hudson Bay!

Yukon River, at old Fort Yukon! and Nulato! Alaska; Porcupine River in Alaska! also Port Clarence! and the Nushagak River.

Snake River, Idaho! Middle Park, Colorado! Upper Missouri in Montana! Utah (Hemphill)!

FIG. 81. *Aplexa hypnorum.*

This well known species is supposed to be circumboreal, but there are some peculiarities in its known distribution. While it extends to northern and western Alaska and down into the mountainous region in Colorado and Utah, it has not been reported so far, authentically, from west of the Cascades, either in the United States or British Columbia. There was one record "near Puget Sound" by Dr. J. G. Cooper, which is cited by W. Cooper and Carpenter, but this refers to a shell obtained at Vancouver, Wash. (not Vancouver Island), by Sir George Simpson, which was afterward described by Dr. Lea as *Physa hordeacea.* It is not positively known that this species is not a *Physa*, though Tryon has referred it to *Bulinus* (= *Aplexa*), on the strength of its general aspect.

A number of varieties have been proposed, but there is not much systematic basis for such of these mutations as I have seen.

Genus **Ancylus** Müller.

Subgenus **Ancylus** s. s.

Patella (sp.) LINNÉ, Syst. Nat., ed. x, p. 783, 1758.
Ancylus GEOFFROY, Traité som. des Coq. Fluv. Paris, pp. 122, 124, 1767; not binomial, sole example *Patella lacustris* Linné. *Ibidem*, translation by Martini, pp. 108, 110, 1767.
Ancylus O. F. MÜLLER, Hist. Verm., II, p. 199, 1774, *A. lacustris* and *fluviatilis* Müller; Zool. Dan. Prodr., p. 237, 1776. — DRAPARNAUD, Tabl., pp. 30, 46, 1801; Hist. des Moll. Terr. et Fluv. de France, pp.

25, 28, 47, 1805. — ROISSY, Moll., v, p. 223, 1805. — BOWDICH, Elem. Conch., I, pp. 24, 63, 1822; *A. fluviatilis* selected as type. — NILSSON, Hist. Moll. Sveciæ, p. 83, 1822. — LAMARCK, Hist. An. s. Vert., VI, 2, p. 25, 1822. — BECK, Ind. Moll., p. 123, 1837; *A. fluviatilis* L., 1st sp. — HALDEMAN, Mon. Limn., p. 14, 1842.

Ancyclus SAY, Nicholson's Encycl., 3d ed., II, p. 14, 1819.

Ancylastrum (sp.) BOURGUIGNAT, P. Z. S., 1853, p. 79, July, 1854. — CLESSIN, Conch. Cab., ed. II, p. 10, 1880; *A. fluviatilis* selected as type. — FISCHER, Man. Conchyl., p. 504, 1883. — TRYON, Struct. and Syst. Conch., III, p. 107, 1884; not *Ancylastrum* Bourg., 1853, typical.

Ansulus sive Ansylus GRAY, in Turton, Man., p. 247, 1840. — HERRMANNSEN, Ind. Gen. Mal., I, p. 52, note 13, 1846.

Ancyllus GRAELLS, Cat. Moll. Espana, p. 22, 1846; err. typ.?

> *Haldemania* CLESSIN, 1880, not of Tryon, 1862.

Subgenus **Acroloxus** Beck.

Acroloxus BECK, Ind. Moll., p. 124, 1837, 1st sp. *A. radiatus* Guilding, 1828, not of Orbigny, 1825; also includes *A. lacustris* (L.) Müller; Herrmannsen, Ind. Gen. Mal., I, p. 16, 1846, selects *A. lacustris* as type. — W. G. BINNEY, Land and Fw. Sh. N. Am., II, p. 147, 1865.

Acroxus BOURGUIGNAT, J. de Conchyl., IV, p. 169, 1853; a modification of *Acroloxus* Beck.

Velletia GRAY, in Turton, Man., pp. 66, 230, 250, 1840; sole ex. *A. lacustris* Müller. — HALDEMAN, Mon. Limn., p. 14, 1842. — GRAY, P. Z. S., 1847, p. 181; *A. lacustris.* — BOURGUIGNAT, J. de Conchyl., IV, p. 63, 1853; P. Z. S., 1853, p. 79, July, 1854. — FISCHER, Man., p. 504, 1883.

Subgenus **Ancylastrum** Bourguignat.

Ancylastrum BOURGUIGNAT, Journ. de Conchyl, IV, pp. 63, 170, 1853 (Feb.), *A. cumingianus* Bourguignat (Tasmania) selected as type; P. Z. S., 1853, p. 91 (not p. 80), 1854. — HEDLEY, Proc. Mal. Soc., I, p. 118, 1894. Not *Ancylastrum* Clessin, 1880, and Westerlund, 1902.

Cumingia CLESSIN, Conch. Cab., ed. II, pt. 299, Mon. *Ancylus*, p. 10, 1880; type *A. cumingianus* Bourg. — TRYON, Struct. Syst. Conch., III, p. 107, 1884. Not *Cumingia* Sowerby, P. Z. S., 1833, p. 34.

Legrandia HANLEY, Proc. Roy. Soc. Tasmania for 1871, p. 27, 1872. Type *A. cumingianus* Bourg.

? Subgenus **Gundlachia** Pfeiffer.

Gundlachia PFEIFFER, Zeitschr. für Mal. for 1849, p. 97, 1850; type *G. ancyliformis* Pfeiffer, Cuba; *cf.* Nordenskiöld, Zool. Anz., XXVI, pp. 590–593, July, 1903; and Dall, Nautilus, XVII, Jan., 1904, pp. 97–8, 1904; also J. G. Cooper, Proc. Cal. Acad. Sci., VI, p. 26, 1875.

Poeyia BOURGUIGNAT, Spicil. Mal., XCIV, Jan., 1862, Rev. de Zool., p. 13, 1862. Sole ex. *P. gundlachioides* Bourg., = *Gundlachia test. juv. fide* Fischer.

The genus *Ancylus* cannot be cited as of Geoffroy, first, because that author did not adopt the Linnean nomenclature, and secondly, because his only species was identified by him with *Patella lacustris* L., which is the type of *Acroloxus*, and, though Bourguignat and

others have tried to propagate the view that Geoffroy's species was the *A. fluviatilis*, their arguments cannot be said to outweigh the positive statement of the original author. The first binomial author to use *Ancylus* was Müller, who must be credited with the genus. The name *Ancylastrum*, published by Bourguignat (though probably suggested by Moquin Tandon) was doubtless intended to be the equivalent of *Ancylus* s. s., but the publishing author distinctly and repeatedly announced the type to be *Ancylus cumingianus*, which differs in many respects from typical *Ancylus*, and will therefore retain the name, which otherwise would have fallen into the synonymy of *Ancylus* s. s. *Acroloxus* Beck, typified by *A. lacustris* Müller, seems to be a well characterized subdivision. Beck's first species was examined by Gray and determined to be a *Velletia*, which is an exact synonym of *Acroloxus*. *Protancylus* was proposed by the Sarasin brothers in 1898, for a form resembling *Ancylus*, from Celebes, but in which the gill is fully developed.

Typical *Ancylus* seems to be an Old World form, but *Acroloxus* is represented in both hemispheres. The subdivisions of the typical subgenus so far recognized are as follows:

? Brondelia Bourguignat, Rev. de Zool, p. 13, 1862; Spic. Mal., xcv, Jan., 1862, type *B. drouetiana* Bourg., Algeria.

This form, which is said to be an air-breather, a fact needing confirmation, is radiately ribbed and has a sinistral apex. More information about it is much needed, and it may prove to be an *Acroloxus*.

Lanx Clessin, Conch. Cab., ed. II, pt. 299, p. 10, 1880; type *A. newberryi* Lea, Oregon and California.

The type has a smooth or concentrically striated apex, subcentrally situated, obtuse; the shell is larger and more solid than the majority of the genus. *A. patelloides* Lea, placed by Clessin with the above, has a shell like *A. newberryi*, but more delicate, depressed, and with a well marked radial system of coloration.

The following groups are Nearctic or American; *Ferrissia* is also South African.

Lævapex Walker, Nautilus, XVII, June, 1903, p. 15; type *Ancylus fuscus* C. B. Adams. Chiefly lacustrine, with a smooth nepionic shell.

Ferrissia Walker, *op. cit.*, p. 15; type *Ancylus rivularis* Say. Chiefly fluviatile, with a radiately sculptured nepionic shell.

The question as to whether *Gundlachia* is a distinct genus or merely an exceptional second-season growth of *Ancylus*, has been discussed

by me in the paper cited in the synonymy, since publishing which I find Dr. J. G. Cooper had also expressed the same opinion in 1875.

Ancylus (Ferrissia) rivularis Say.

Ancylus rivularis SAY, Journ. Acad. Nat. Sci., I, p. 124, 1817.— HALDEMAN, Mon. Limn., p. 4, pl. 1, fig. 1, 1844 (Delaware River).
Ancyclus rivularis SAY, Nicholson's Encyclopedia, 3d ed., Art. Conchology, vol. II, p. 14, 1819.
Ancylus (Ferrissia) rivularis BRYANT WALKER, The Nautilus, XVII, No. 2, p. 15, June, 1903; XVIII, No. 2, p. 17, pl. 1, figs. 1–10, 13–15, June, 1904.

Range. — Northern United States east of the Mississippi, New Mexico, Canada, Manitoba.

Souris River, Manitoba, Dawson.

Ancylus (Ferrissia) parallelus Haldeman.

Ancylus parallelus HALDEMAN, Mon. Limn., pt. 2, p. 3 of cover, 1841 (Vermont); pt. 7, p. 11, pl. 1, fig. 6, 1844.— BINNEY, Land and Fw. Sh. N. Am., II, p. 142, 1865.

Range. — New England; Canada, Manitoba.

Pine Creek; Rainy River; and Lake of the Woods, in Manitoba.

Ancylus (Lævapex) fragilis Tryon.

Ancylus fragilis TRYON, Proc. Acad. Nat. Sci. Phila., for 1863, p. 149, pl. 1, fig. 15.— BINNEY, Land and Fw. Sh. N. Am., II, p. 146, fig. 246 (California), 1865.—TRYON, Mon. Fw. Univ. Moll. U. S., p. 229, pl. 2, figs. 17, 18, 1872.
?*Ancylus caurinus* COOPER, Rep. N. Hist. Wash., p. 378, 1859; Pacific R. R. Reps., XII, p. 378, 1859, nude name.—BINNEY, Land and Fw. Sh. N. Am., II, p. 144, fig. 243, 1865; Proc. Cal. Acad. Sci., IV, p. 100, 1870. Black River, Puget Sound.

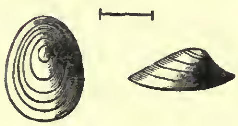


FIG. 82. *Ancylus kootaniensis* Baird.

Range.—California; Puget Sound drainage (*caurinus*), Vancouver Island near Victoria! (*caurinus*).

Tryon unites these under his prior name. The Vancouver specimens are certainly identical with Cooper's shell.

Ancylus (Lævapex) kootaniensis Baird.

Ancylus kootaniensis BAIRD, Proc. Zool. Soc. London, for 1863, p. 69.— BINNEY, Land and Fw. Sh. N. Am., II, p. 144, fig. 242, 1865. —TRYON, Mon. Fw. Univ. Moll. U. S., p. 227, pl. II, figs. 11–12, 1872.

Range. — Kootenai and Spokane Rivers, British Columbia.

Family SIPHONARIIDÆ.

Genus **Siphonaria** Sowerby.

Siphonaria SOWERBY, Genera of Shells, pt. XXI, Jan., 1824; Proc. Zool. Soc. London, for 1835, p. 6.—DALL, Am. Journ. Conch., VI, p. 31, 1870.
Muretia D'ORBIGNY, Voy. Am. Mérid., p. 682, 1846. Not *Mouretia* Sowerby, 1835.
Trimusculus (SCHMIDT, MS.) MÖLLER, Isis, 1832, p. 132.
? Liria GRAY, Phil. Mag. and Journ., LXIII, p. 275, April, 1824.

The type of *Liria* is *Le Liri* Adanson, Sénégal, p. 32, pl. 2, fig. 2, 1757; stated by Gray to be a synonym of Sowerby's genus, but it is probable that Adanson's shell is not a *Siphonaria*.

Subgenus **Siphonaria** s. s.

Siphonaria DALL, Am. Journ. Conch., VI, p. 31, 1870.

Shell solid, porcellanous, with subcentral apex and radial sculpture; inner lateral teeth of the radula bifid, outer trifid. Habitat, tropical or warmer seas. Type, *S. sipho* Sowerby.

Subgenus **Liriola** Dall.

Liriola DALL, Am. Journ. Conch., VI, p. 32, 1870.

Shell thin, horny, with apex eccentric; smooth or faintly radially striate. Habitat, cooler or temperate seas. Type *S. thersites* Carpenter.

Siphonaria (Liriola) thersites Carpenter.

Siphonaria thersites CARPENTER, Ann. Mag. N. Hist. (3), XIV, p. 425, Dec., 1864. Neah Bay, Wash.
Siphonaria (Liriola) thersites DALL, Am. Journ. Conch., VI, pp. 32, 33, pl. IV, fig. 8, pl. V, figs. 2, 5, 1870.

Range.—Strait of Fuca to the Aleutian Islands, on stones near low water mark.

Neah Bay, Wash.! Victoria, British Columbia; Fort Simpson, British Columbia; in Alaska at Port Mulgrave! Port Etches! St. Paul, Kadiak! Chirikof Island! Semidi Islands! Simeonof Island and Popof Strait, Shumagin Islands! Chika Islands, Unalga Pass! Captains Harbor, Unalaska! Constantine Harbor, Amchitka! Kiska Harbor, Kiska Island, Aleutians.

This is one of the most common and characteristic mollusks of the northwest coast. It lives between tidemarks, often where it must be submerged twenty out of twenty-four hours of the day, but is sometimes dredged in 20 fathoms, dead.

Family ONCHIDIIDÆ.

Genus **Onchidium** Buchanan, 1800.

Type *Onchidium typhæ* Buchanan, Trans. Linn. Soc., v, p. 132, 1800.

Subgenus **Onchidella** Gray, 1850.

Type *Onchidium nigricans* Quoy, Fig. Moll. An., iv, p. 117, pl. 181, fig. 1, 1850 (selected as type by Herrmannsen, Ind. Gen. Mal., Suppl., 1852).

Dorsal surface without arborescent processes, margin of the mantle with prominent spaced papillæ, serving as conduits for mucous glands; lower surface of the mantle with muciparous glands; dorsum with dorsal eyes; mouth agnathous. Warmer seas.

Section Arctonchis Dall, nov.

Species small, like *Onchidella*, but without muciparous glands on the lower side of the mantle, without dorsal eyes and with a jaw. Cool temperate and boreal coasts.

Type *Onchidella borealis* Dall.

I had long since proposed to retain for this group the name *Onchidella*, supposing that name to be practically a synonym of *Onchidium*. This, however, is not now regarded as allowable, and *Onchidella* must follow the fate of its type.

I propose therefore the sectional name *Arctonchis* for the group of small boreal *Onchidella* which includes at least *O. borealis* and *O. celtica* Forbes and Hanley.

Onchidella (Arctonchis) borealis Dall.

Onchidella borealis Dall, Am. Journ. Conch., vii, p. 135, 1871. — W. G. Binney, Proc. Acad. Nat. Sci. Phila., 1876, p. 84, pl. vi, figs. e, ee, Sept., 1876. — Binney, Terr. Airbr. Moll. U. S., Third supple., Bull. Mus. Comp. Zool., xix, No. 4, pl. vi, figs. d, e, 1890 (called *carpenteri* by error, in text pp. 214, 224); Fourth Supplement, Bull. Mus. Comp. Zool., xxii, No. 4, p. 202, 1892.

Onchidium boreale Dall, Semper, Arch. Phil. Bd. 3, heft vi, p. 282, pl. xxi, fig. 13.

Range. — California to Bering Sea on the N. W. coast of America.

California (Binney); Coos Bay, Oregon (Hemphill); Victoria, Vancouver Island! Lituya Bay! Port Mulgrave! Port Etches! Unalaska! and Port Möller on Bering Sea! in Alaska.

Observations on this species have been published by the writer, Mr. W. G. Binney, Semper, and Henry Hemphill; and, as their articles are short and widely scattered in the literature, an abstract of the

whole, with additions, is now given so that the data in regard to this species may be obtained in one place.

The animal lives between tides, where at high water it is covered by the sea, usually on stones or projecting rocks, either where it is covered with *Fucus* or on the underside of stones which thus form a shelter. It seems to be gregarious in its habits, as many as fifty specimens having been taken from a single crevice in shaly rock. When in motion it moves quite rapidly for so small an animal, with two short stout tentacles tipped by keen black eyes protruding beyond the front edge of the mantle. The upper surface is dark slate color, with spots or streaks of light gray or whitish. It appears smooth, but as if having small round tubercles beneath the smooth skin, which when the animal is contracted in alcohol are much more conspicuous than in life. Around the edge of the mantle is a single row of larger and more prominent tubercles corresponding to an equal number of mucous glands. These, projecting, give the margin a serrate or fringed appearance. The animal, when in motion, is about twelve millimeters long, four and one half wide, and three millimeters high, oblong oval in form, a little wider behind than in front. When at rest in a contracted state it is nearly circular in form, a little longer than wide, the center of the dorsum elevated in a bluntly pointed manner, giving the creature much the aspect of a young *Acmæa*. The lower surface of the body is of a greenish white, and, when the animal is moving, the foot seems to undergo rapid undulation. The muzzle exhibits anterior ovate extensions separated by a sulcus in the median line, as in other species of the genus.

Neither *Onchidella borealis* nor *O. celtica* possesses the singular dorsal eyes characteristic of many tropical species.

O. borealis differs from *O. carpenteri* Binney, and all the other species of the family now known (except *O. celticum*), in possessing a thin delicate smooth jaw, the presence of which has been demonstrated by both Binney and Semper. According to Joyeaux Laffluie *O. celticum* also possesses a jaw, though the surface of the dorsum is, if the figure given by Forbes and Hanley be accurate, much more prominently tuberculous than in *O. borealis*. *O. carpenteri* Binney, a small species reported by Binney from California and Puget Sound, is according to that author agnathous, and therefore belongs to the typical section of the genus.

The dentition of *O. borealis* has been worked out by Binney and confirmed by Semper. The radula is long and wide, the teeth arranged strongly *en chevron*, with a formula of $\frac{61}{2} \cdot \frac{1}{3} \cdot \frac{61}{2}$. The rhachidian

tooth is large, longer than wide, truncated above, expanded below its middle, and incurved at the basal margin. The reflected portion is large, tricuspid, the cusps prominent. The laterals have a long, narrow base of attachment, a small portion of its upper part thrown outward, the rest curving inward, giving an irregular arcuate form to the base as a whole; the anterior and posterior margins of this base are abruptly truncate. The reflected part is rather posterior and carries a large, wide, expanding, bluntly truncated cusp on the outer side, and on the inner a very small conical cusp. The successive teeth laterally from the middle of the radula at first increase, then gradually decrease in size, but retain essentially the same characters to the outer termination of the row.

From the typical *Onchidium* (*schrammi* Bland and Binney, Guadeloupe, W. I.) the teeth differ by the wider rhachidian, with more nearly equal cusps, by the presence of two distinct cusps on the laterals, and by the curve of the lateral bases, which in *O. schrammi* have their posterior portions curved toward the center of the radula, while in *O. borealis* the curve is in the opposite direction. In *Onchidella floridana* Dall, an oculiferous agnathous species from Knight's Key, Florida, the discrepancy of the rhachidian cusps and the curve of the lateral bases agree with *O. schrammi*, but there is a small accessory inner cusp to the laterals.

Mr. Binney informs me that the liver in *O. borealis* is in fasciculi of long cæca, one on each side; there is also an accessory lateral pouch to the stomach, which also has a fasciculus of cæca, making three biliary ducts.

According to Semper this species agrees in most respects with the fifth of the groups into which he divides *Onchidium*. There is a single row of large glands which open through equally spaced small tubercles on the mantle edge. The other glands, which in the other species (except *O. celtica*) empty on the under surface of the mantle, are absent in this form. The penis is short and thick, consisting of two well marked portions. In the posterior thinner part a short broad penial papilla is present, at the base of which the spermatic duct opens. The wall of this part is marked by extremely shallow grooves in which concretions are present, very like those found in the deep grooves of other species. The spermatic cord is short and feebly twisted. The penial retractor muscle is thin and attached proximally to the middle of the pericardial sac on the inner surface of the foot. The jaw and radula are as described by Binney.

I should like here to record my dissent from the ingenious hypothesis

by which Semper associated the occurrence of dorsal eyes in *Onchidium* with the presence of the fish *Periopthalmus*. There are both oculiferous and (dorsally) blind species of *Onchidium* in the Galapagos, and an oculiferous species in Florida and Bermuda, and in neither of these regions is *Periopthalmus* known. It is of course not only necessary that an hypothesis should account for the facts, but that it also should be true, but the latter half of the proposition is only too liable to be left unverified.

Family AURICULIDÆ.

Genus Carychium Müller.

Carychium O. F. MÜLLER, Hist. Verm., II, p. 125, 1774; sole ex. *C. minimum* Müller; Zool. Dan. Prodr., p. XXIX, 1776.— DRAPARNAUD, Hist. Moll. Terr., p. 57, 1805 (in synonymy).
Helix (sp.) GMELIN, Syst. Nat., VI, p. 3665, 1792.
Bulimus (sp.) BRUGUIÈRE, Encyc. Méth., I, p. 310.
Turbo (sp.) MONTAGU, Test. Brit., p. 339.
Auricula (sp.) DRAPARNAUD, Tableau des Moll., p. 54, 1801; Hist., p. 57, pl. III, figs. 18, 19, 1805.
Odostomia (sp.) FLEMING, Edinb. Encycl., VII, p. 76, 1817.
Auricella (BRARD MS.) JURINE, Helvet. Almanach, p. 34, 1817.— HARTMANN, in Steinmüller, Neue Alpina, I, pp. 49, 205, 215, 1821; and Sturm, Fauna, VI, heft V, p. 36, 1821; Syst. Uebersetz., table, 1840.— MOQUIN TANDON, Hist. Moll. Terr. Fr., II, p. 413, 1855. Type *C. minimum* Müller.
Auriculina MOQUIN TANDON, Hist. Moll. Terr. Fr., II, p. 646, 1855; not of Grateloup, 1838, nor Gray, 1847.
Saraphia (sp.) RISSO, Hist. Eur. Mér., IV, p. 84, 1826; *S. tridentata* Risso.
< *Carychium* LEACH, Zool. Misc., I, p. 85, 1814.— FÉRUSSAC, Prodr., p. 100, 1819; Tabl. Syst., p. XXXIII, 1821.—BLAINVILLE, Dict. Sci. Nat., VII, p. 187.—MOQUIN TANDON, Hist. Moll. Terr. Fr., pp. 412, 413, 1855.

FIG. 83. *Carychium exiguum* Say. Animal and shell magnified.

The species of this genus are so small that a special search almost is necessary to determine their presence or absence in a given locality.

So it is uncertain whether the range herein reported might not be considerably extended if thorough collecting had been done.

Carychium exiguum Say.

Pupa exigua SAY, Journ. Acad. Nat. Sci. Phila., II, p. 375, 1822.— GOULD, Boston Journ. Nat. Hist., III, p. 398, pl. III, fig. 20, 1841.
Carychium exiguum PFEIFFER, Wiegman's Archiv, I, p. 224, 1841.—BINNEY, Land and Fw. Sh. N. Am., II, p. 6, figs. 5–9, 1865.

Range. — Temperate North America.

At Brandon, Pine Creek, and Carberry, Manitoba; Salt Spring Island, and at Comox, Vancouver Island, British Columbia.

Carychium exile Lea.

Carychium exile H. C. LEA, Am. Journ. Sci., 1st ser., XLII, p. 109, pl. I, fig. 5, 1841. — TROSCHEL, Arch. für Naturg., II, p. 128, 1843. Not *C. exile* C. B. Adams, Contr. Conch., III, p. 38, 1849 (Jamaica).

Range. — Eastern United States. Manitoba, in drift of the Red River of the North.

In the description of the animal of *Carychium* cited by Binney (under *C. exiguum*) and copied by Baker (Moll. Chicago Area, II, p. 254) the writer has confused the anterior end of the wide muzzle with the foot, although, by the figure adjacent to this paragraph, the relation of the parts is clearly shown. The foot of the animal is not "divided into two segments," but is entire, as required by the generic diagnosis.

Family STREPOMATIDÆ.

Genus **Pleurocera** Rafinesque.

* **Pleurocera canaliculata** Say.

Melania canaliculata SAY, Journ. Acad. Nat. Sci. Phila., II, p. 175, 1821. Ohio.
Melania conica SAY, *op. cit.*, p. 176, 1821. — SOWERBY, in Richardson, Fauna Boreali Am., III, p. 316, 1836.

Range. — Ohio, Tennessee and Alabama, Indiana and Illinois.

This species is cited in J. de C. Sowerby's very inaccurate list, as coming from "Lake Superior to the Saskatchewan." No subsequent collector has confirmed this statement, which is doubtless entirely erroneous.

Genus **Goniobasis** Lea.

Goniobasis plicifera Lea, var. **silicula** Gould.

Melania plicifera LEA, Trans. Am. Phil. Soc., VI, p. 93, pl. XXIII, fig. 90, 1836. Oregon.
Melania silicula GOULD, Proc. Bost. Soc. Nat. Hist., II, p. 224, 1847; Wilkes' Exped., Moll., p. 141, figs. 164, 164*a*, 1852. Nisqually, Oregon.

Range. — Northern California, Oregon and Washington.

Vancouver Island (Forbes)? British Columbia in streams west of the Cascades (Lord).

This species so much resembles the viviparous *Melania* of the Hawaiian Islands and the Orient, which has a fringed mantle edge, that for a long time it was doubted whether the little group of Pacific Coast species was not related to the oriental forms rather than to the *Goniobasis* of the eastern United States. An examination of the living animal by the writer a few years ago showed, however, that the Oregon species has a plain mantle edge and is oviparous, so that the resemblance referred to, though obvious, is probably merely the result of convergence, and expresses no intimate relationship.

Tryon regarded Gould's *silicula* as a species; others have thought it a variety of the older *plicifera*. Further studies are necessary to determine the question.

Family AMNICOLIDÆ.

Genus **Amnicola** Gould and Haldeman.

Amnicola limosa Say.

Paludina limosa SAY, Journ. Acad. Nat. Sci. Phila., I, p. 125, 1817. — NICHOLSON'S Encyc., third American ed., p. 12, 1819.
Paludina porata SAY, Journ. Acad. Nat. Sci. Phila., II, p. 174, 1821.
Amnicola porata GOULD, Inv. Mass., p. 229, fig. 157, 1841.
Amnicola limosa HALDEMAN, Mon. Limn., p. 10, pl. I, figs. 5, 6, 1845. — BINNEY, Land and Fw. Sh. N. Am., III, p. 84, fig. 166, 1865.
Lyogyrus lehnerti ANCEY (MONSTR.).

FIG. 84. *Amnicola limosa.*

Range. — Virginia to Wisconsin and Hudson Bay.

Lake Superior to the Height of Land; Athabaska at Lake La Loche (Richardson), N. Lat. 56° 30′; Lake of the Woods; Manitoba; Moose Factory, Hudson Bay! Big Sioux River, Nebraska! Salt Lake basin, Utah Lake! Utah.

FIG. 85. *Amnicola pallida.*

This is the type of the genus, and it seems to reach the headwaters of the Atlantic and Hudson Bay drainage but not to reach the drainage on the other side of the watershed alluded to.

Amnicola pallida Haldeman.

Amnicola pallida HALDEMAN, Mon. Limn., pt. III, cover p. 3, 1842, pt. VIII, p. 12, pl. I, fig. 7, 1845. — BINNEY, Land and Fw. Sh. N. Am., III, p. 83, fig. 165, 1865.

Range. — New York northward to Canada and Manitoba.

Lake Winnipeg, Brandon, and Pine Creek, Manitoba.

These northern localities are cited from the literature. I have seen no Manitoban specimens.

Amnicola emarginata Küster.

Paludina obtusa LEA, Proc. Am. Phil. Soc., II, p. 34, 1841, not of Troschel, 1837.
Paludina emarginata KÜSTER, Conch. Cab., ed. II, Mon. *Paludina*, p. 50, pl. x, figs. 3, 4, 1852.
Amnicola cincinnatiensis BINNEY, Land and Fw. Sh. N. Am., III, p. 85, fig. 169, 1865, not of Anthony?

Range. — Ohio and northward to Moose River, Hudson Bay.

FIG. 86. *Amnicola emarginata* Küster (magnified).

Red River of the North; Manitoba; lower Saskatchewan, near Lake Winnipeg! Moose Factory! N. Lat. 51° on Hudson Bay.

More or less confusion has existed between the various shells which have carried the specific name *cincinnatiensis* in this family. The present species is the small shell with a flat planorboid apex which has usually been called *Bythinella obtusa* Lea. Baker, in his Mollusks of the Chicago Area, unites *cincinnatiensis* Binney with this species. It does not seem to me to resemble the *obtusa* of Lea, particularly.

Amnicola cincinnatiensis Anthony.

Paludina cincinnatiensis ANTHONY, Boston Journ. Nat. History, III, p. 279, pl. III, fig. 3, 1840.
Amnicola (*Cincinnatia*) *cincinnatiensis* BAKER, Moll. Chicago Area, II, p. 325, pl. XXVI, fig. 14, 1902.

FIG. 87. *Amnicola cincinnatiensis.*

Range. — New York to Utah, Texas to Hudson Bay. Moose Factory, Hudson Bay!

The identity of the Hudson Bay specimens is apparently indubitable. The species is asserted by Pilsbry to occur in Texas and at various points in the basin of Great Salt Lake, Utah.

Genus **Lyogyrus** Gill.

Lyogyrus granum Say?

Paludina grana SAY, Journ. Acad. Nat. Sci. Phila., II, p. 378, 1822.
Amnicola granum HALDEMAN, Mon. Limn., VIII, p. 17, 1845. — BINNEY, Land and Fw. Sh. N. Am., III, p. 86, fig. 170, 1865.

Range. — Virginia northward to the Great Lakes and Manitoba? Pennsylvania (Say). Pine Creek, Manitoba (Miller Christy).

Dr. Pilsbry, in the Nautilus (XII, No. 4, p. 42, 1898), says that the Canadian and northwestern specimens are not of the same species as

Say's Pennsylvania type. The above range is taken from the literature; not having seen Manitoba specimens I am unable to determine what species they represent, but it appears that there is a small species in Manitoba resembling *L. granum.*

FIG. 88. *Lyogyrus granum*, 4/1.

Genus **Fluminicola** Stimpson.

Fluminicola nuttalliana Lea.

Paludina nuttalliana LEA, Trans. Am. Phil. Soc., VI, p. 101, pl. XXIII, fig. 109, 1839.
Paludina seminalis HINDS, Zool. Sulphur Voy. Moll., p. 59, pl. XVI, fig. 22, 1844.
? *Amnicola hindsii* BAIRD, P. Z. S., London, 1863, p. 67.

FIG. 89. *Fluminicola nuttalliana*, 4/1.

FIG. 90. *Fluminicola hindsii* Baird, 1/1.

Range. — California to British Columbia. Variety *hindsii* in Kootenai River and Wigwam River, at the foot of the Rocky Mountains, at an elevation up to 4,626 feet.

I have not seen any British Columbian specimens and accept the identity of *F. hindsii* and *nuttalliana* on Mr. Binney's authority. According to Dr. Pilsbry this species is common to the Columbia River drainage of British Columbia and the United States.

FIG. 91. *Fluminicola virens* (magnified).

Fluminicola virens Lea.

Paludina virens LEA, Trans. Am. Phil. Soc., VI, p. 91, pl. XXIII, fig. 93, 1839.
Paludina nuclea LEA, *op. cit.*, p. 91, pl. XXIII, fig. 103, 1839.

Range. —Oregon, Willamette River, Washington, and Vancouver Island.

In this instance the Vancouver habitat is cited from the literature.

Genus **Pomatiopsis** Tryon.

Pomatiopsis lapidaria Say.

Cyclostoma lapidaria SAY, Journ. Acad. Nat. Sci. Phila., I, p. 13, 1817.
Amnicola lapidaria HALDEMAN, Mon. Limn., VIII, p. 18, pl. I, fig. 10, 1845.
Pomatiopsis lapidaria TRYON, Proc. Acad. Nat. Sci. Phila., for 1862, p. 452 (name only). — STIMPSON, Smithsonian Misc. Coll., Mon. Hydrobiinæ, pp. 29–36, figs. 22–26, 1865.

Paludina lustrica SAY, Journ. Acad. Nat. Sci. Phila., II, p. 175, 1821.
Pomatiopsis lustrica BINNEY, Land and Fw. Sh. N. Am., III, p. 94, fig. 189, 1865, Cayuga Lake, N. Y.

FIG. 92. *Pomatiopsis lapidaria* Say.

Range. — Eastern North America from Georgia to Iowa and Hudson Bay.

Moose Factory, N. Lat. 51°, on Hudson Bay.

There is some doubt as to whether Say's *lustrica* is the young of his *lapidaria* or not. I have followed the general usage in uniting them. If they should prove distinct it is, according to Mr. Binney, the *P. lustrica* which occurs in the Northwest and on the watershed south of Hudson Bay.

Family VALVATIDÆ.

Genus **Valvata** Müller.

Valvata MÜLLER, Hist. Verm., II, p. 198, 1774; sole ex. *V. cristata* Müller, Europe; Zool. Dan. Prodr., p. 239, 1776. — DRAPARNAUD, Tableau, pp. 30, 42, 1801; Hist. Moll. Terr. et Fluv. France, pp. 26, 28, 41, 1805. — ROISSY, Hist. Nat. Moll., V, p. 379, 1805. — LAMARCK, Hist. An. s. Vert., VI, 2, p. 171, 1822.
Valvata + *Valvearus* DUMÉRIL, Zool. Anal., p. 164, 1806.
(?) *Cincinna* HÜBNER, Zwei Briefe, I, 1810, *fide* Menke, in Herrmannsen, Ind. Gen. Mal. Suppl., p. 50, 1852.
Gyrorbis FITZINGER, Verz, p. 117, 1833; type ?? *cristata* Müller.
> *Valvata* FITZINGER, Verz, p. 117, 1833; type *V. piscinalis* (Müller).
Planella SCHLÜTER, Syst. Verz. Conchyliensammlung, p. 13, 1838; sole ex. *Valvata cristata* Müller.
Volvata BERGE, Conch. Buch, pp. 17, 20, 26, 1847; *err. typ.?*
Tropidina H. and A. ADAMS, Gen. Rec. Moll., I, pp. 343, 344, 1854, type *V. tricarinata* Lesueur, N. Am.
Concinna 'HÜBNER,' *fide* H. and A. Adams, *op. cit.*, p. 343, 1854.
> *Valvata* SCHLÜTER, *op. cit.*, p. 13, 1854; *V. piscinalis* Fér.
> *Cincinna* MÖRCH, Vidensk. Meddel. for 1863, p. 321, 1864. — WESTERLUND, Fauna Pal. Reg., VI, pp. 131, 132, 1886. (Type *V. piscinalis* Müller?)
> *Tropidina* MÖRCH (not Adams), Vidensk. Meddel. Kjöb., for 1863, p. 320, 1864, *V. minuta* Drap., 1st sp.
> *Ielskia* BOURGUIGNAT, Descr. Nouv. Gen. Alg., 1877, *V. jelskii* Crosse, 1863, Russia, named for Prof. Jelski, of Kieff.
> *Jelskia* WESTERLUND, Fauna Pal. Reg., VI, p. 143, 1886; not of Taczanovich, *Arachnida*, 1871.
> *Gyrorbis* WESTERLUND, Fauna Pal. Reg., VI, p. 142, 1886.

This genus has been subdivided, according to the form of the shell, into the following sections, which appear, however, to have very little value.

Valvata s. s. (*Gyrorbis* Fitz.) Shell planorboid or depressed, without spiral keels. Type *V. cristata* Müller.

Cincinna Mörch (*Valvata* Fitz.). Shell turbinate, with a mod-

erate number of whorls slowly enlarging and without spiral keels. Type *V. piscinalis* (Müller).

Ielskia Bourguignat (*Jelskia* West., not Tacz.). Shell turbinate, with few rapidly enlarging whorls and no spiral keels. Type *V. jelskii* Crosse.

Tropidina H. and A. Adams. Shell depressed turbinate, with the upper surface of the spire more or less flattened and the whorls spirally keeled. Type *V. tricarinata* (Lesueur) Say.

Since Müller associated but one species with the genus when described, that species necessarily becomes the type. A failure to recognize this, when subdividing the genus, is responsible for several of the synonyms. I have not been able to consult Hübner's Zwei Briefe, and cite him on the authority of Westerlund, but, judging by his paper on *Cobresia* of the same year, his nomenclature was not Linnean, although his artistic capacity seems to have been exceptional.

Valvata tricarinata Say.

Cyclostoma tricarinata SAY, Journ. Acad. Nat. Sci. Phila., I, p. 13, 1817.
Valvata tricarinata SAY, *op. cit.*, II, p. 173, 1821.—GOULD, Inv. Mass., p. 225, fig. 156, three views, 1841.—HALDEMAN, Mon. Limn., VIII, p. 3, pl. I, figs. 1–4, 1845.
Valvata carinata SOWERBY, Genera, part XLI, fig. 2, 1834.
Valvata unicarinata DE KAY, Zool. N. Y., Moll., p. 118, pl. VI, fig. 129, 1843.
Valvata tricarinata var. *simplex* GOULD, Inv. Mass., p. 226, fig. 156 (right hand figure), 1841.
Valvata humeralis MILES, Geol. Surv. Michigan, p. 237, 1860, not of Say.
Valvata tricarinata var. *confusa* BRYANT WALKER, Nautilus, XV, No. 11, p. 124, fig. 2, 1902.

Range.—From New England and Virginia westward to the Missouri, and northward.

Type: St. Lawrence River and the Great Lakes! Manitoba, in Great Playgreen and Winnipeg Lakes! and Pine Creek; Red Deer, Alberta; Moose Factory, Keewatin; Saskatchewan River! Great Slave Lake! Methy Lake in Lat. 57° N.

Variety *simplex:* English River, Keewatin! Peace River, Athabaska! Great Slave Lake, at Fort Resolution! upper Mackenzie River at Fort Simpson! in N. Lat. 62°.

FIG. 93. *Valvata tricarinata*, $\frac{1}{1}$.

Full grown specimens of this species have three and a half whorls, a maximum diameter of 5, and an altitude of 3 mm. This applies to both varieties, though under exceptionally favorable circumstances it may be somewhat exceeded. The aperture is orbicular and almost vertical in plane.

Valvata sincera Say.

Valvata sincera SAY, Rep. Long's Exp., II, p. 264, pl. XV, fig. 11, 1824.

Range. — Northwest Territory (Bigsby, *fide* Say) southeast Keewatin in Attawapiskat and Kawinogans Rivers (McInnes) and the southwest point of Anticosti (McCann).

This shell, according to Say's original description and figure, is "subglobose-conic" with "nearly four whorls," "finely and regularly wrinkled across," with a large umbilicus "exhibiting the volutions,' and a diameter, at right angles to the axis, of slightly less than three millimeters, as engraved on the plate in Long's Expedition. I have not seen any shell corresponding to these characters from the northern United States, but Dr. Whiteaves has kindly sent me for examination some shells from southern Keewatin and Anticosti which may prove to be Say's *sincera.* In the literature and in collections we find the ecarinate *tricarinata* (*simplex* Gould) and all the non-carinated forms of the United States generally labelled '*sincera* Say,' '*simplex* Gould,' etc. Those specimens of *tricarinata* which preserve the 'subglobose' outline have an umbilicus smaller than the carinate shells instead of larger. The very flat and widely umbilicate form which is most generally labelled *sincera*, following Haldeman's figures, is much more like the *cristata* of Europe than it is like Say's shell. The specimens which have been called *sincera* in the literature of the region we are now interested in are, so far as I have been able to examine them, all of the next species.

The only shells in the National Museum which at all resemble Say's *sincera* are a series received from Aroostook County, Maine, collected by O. Nylander, which differ sufficiently to be called at least a very marked variety.

Valvata (sincera var.?) **nylanderi** nov.

Shell small, subglobose-conic, with four whorls of a pale greenish straw color; surface polished, with faint spiral striæ, sculptured axially with thin, sharp, elevated, rather distant lamellæ like those on *Zoögenites harpa* or *Planogyra asteriscus* Morse; these lamellæ are closer and less elevated on the apical part of the shell; vertex, including most of the first two whorls, somewhat flattish or planorboid, after which the shell becomes subconic; the sutures deep; the base rounded, with a narrow but very deep umbilicus; plane of the aperture nearly vertical, the aperture orbicular, with simple sharp edges; the operculum multispiral, of the same color as the shell. Axial height 3.2 and 3.4; diameter 3.5 and 3.7; diameter of umbilicus .05 and

.07 ; of aperture 1.5 and 1.7 mm., in the broadest and narrowest specimens, respectively.

Valvata lewisi Currier.

Valvata striata LEWIS, Proc. Acad. Nat. Sci. Phila., for 1856, p. 260.— BINNEY (as var. of *sincera*), Land and Fw. Sh. N. Am., III, p. 12, fig. 18, 1865 ; not of Philippi, 1836.

Valvata sincera HALDEMAN (*pro parte*), Mon. Limn., VIII, pl. 1, figs. 6, 7, 8, 1845.

Valvata lewisi CURRIER, List Moll. Mich., Kent Sci. Inst. Misc. Pub., No. 1, p. 9, 1868 ; new name for *V. striata* Lewis, not Philippi.

Range. — Northern United States from the Atlantic to the Pacific, and northward.

New England ! Minnesota ! Colorado ! Lake Washington near Seattle ! San Bernardino Mountains, Calif. ! Utah ! Lake Superior ! Anticosti Island ! Pine Creek, Manitoba ! Laggan, Alberta, at 5,200 feet elevation ; Assiniboia ; Lake La Loche and Peace River, Athabaska ; Great Slave Lake ! Fort Simpson, upper Mackenzie River, N. Lat. 62° ! Frances Lake, head of the Liard River ! Fort Chimo, Labrador ! Sturgeon Lake, Athabaska ! Upper Columbia Lake ! (Tyrrell).

FIG. 94. *Valvata lewisi* Currier, $\frac{1}{1}$.

The name seems to have been originally proposed for a brown mutation of *V. sincera* Haldeman (*non* Say), but may well be extended to cover the whole species, which has no other available name. The shell when normally developed and adult has four whorls with a height of 3.6 and a diameter of 5.75 mm. It has a much wider umbilicus than var. *simplex* of *tricarinata* and is a larger shell, yet usually has a smaller protoconch. The sculpture is axial, fine and close, like the winding of thread on a spool. In the typical form this sculpture is coarser and more prominent than in the less common *helicoidea*. In both it is largely resident in the periostracum, the decorticated shell being nearly smooth.

Valvata lewisi var. **helicoidea** nov. Pl. II, figs. 1, 2.

This form resembles *lewisi* but is more depressed, almost flat above, and more or less flattened toward the suture ; the whorls are more slender and near the aperture usually rather suddenly expanded ; the surface is polished, the sculpture frequently obsolete, the umbilicus wide, and its bounding coil peripherally diverted during the growth of the last half whorl ; height 2.5 ; of the aperture 2.0 ; diameter of shell 5.0 mm.

Range. — With the type form, to some extent everywhere, but especially toward the Northwest. Lake Bennett, Yukon Territory ! near

Old Fort Yukon, Alaska! thirty miles below Tanana on the Yukon River! Lake Lindeman; East Kootenai district, British Columbia.

This form is very close to *V. sibirica* Middendorff, which however has a more depressed apex and uniform fine sharp sculpture. *V. cristata* is of the same type, but much smaller.

Valvata mergella Westerlund.

Valvata mergella WESTERLUND, Vega Exped. Vetens. Iakt., IV, p. 209, pl. V, figs. 22, *a–d*, 1885.

Range. — Port Clarence, near Bering Strait, Alaska (Vega); Popof Island, Shumagins, in small ponds (Kincaid); Stewart River, Yukon district (Canadian Geol. Survey).

This is the largest species of its group, measuring 5 mm. high and 7 mm. wide, with four whorls. The aperture is markedly expanded, the sculpture very fine and rather sharp. The protoconch in the Shumagin specimens is very minute. The expansion of the aperture tends to narrow the umbilicus, as it were at the last moment.

Valvata virens Tryon.

Valvata virens TRYON, Proc. Acad. Nat. Sci. Phila., for 1863, p. 148, pl. I, fig. 11.—BINNEY, Land and Fw. Sh. N. Am., III, p. 15, fig. 21, 1865.

FIG. 95. *Valvata virens* Tryon, operculum, magnified.

Range. — Clear Lake, California, to Vancouver Island, at Nanaimo.

A well marked species of more than usually trochoid form, recalling *V. piscinalis* of Europe, but large, more solid, and when in good condition of a peculiarly elegant green tint. The figures given in Tryon's description are of immature specimens. Binney figures an adult specimen but does not give the measurements.

Family VIVIPARIDÆ.

Genus **Campeloma** Rafinesque.

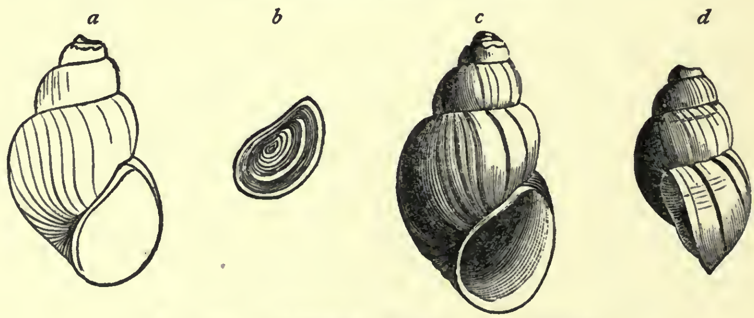


FIG. 96. *Campeloma decisum*; *b*, operculum.

Campeloma decisum Say.

Limnæa decisa SAY, Nicholson's British Encyclopedia, 1st Am. ed., pl. III, fig. 6, 1817.
Paludina decisa SAY, *op. cit.*, 3d ed., pl. III, fig. 6, 1819. — HALDEMAN, Mon. Limn., *Paludina*, p. 4, pl. I, 1840.
Melantho decisa BINNEY, Land and Fw. Sh. N. Am., III, p. 41, figs. 79–82. 1865.

Range. — Eastern North America from the Rio Grande to Nova Scotia, west to Nebraska, north to the Saskatchewan. Lake Superior to the Saskatchewan (Richardson); Lake of the Woods, Manitoba, (rare, Hanham).

It is not unlikely that the extension of the range of this species as far north as the Saskatchewan is unwarranted, so many of the data in Sowerby's list, in Richardson, seem erroneous, but the presence of the species in the Lake of the Woods seems authentic.

NAIADES.

In discussing the Naiades, the arrangement proposed by Mr. Chas. T. Simpson, in his recent Synopsis of the Naiades,[1] is adopted, which see for fuller synonymy.

Genus **Lampsilis** Rafinesque.

Lampsilis ventricosus Barnes.

Unio ventricosus BARNES, Am. Journ. Sci., 1st ser., VI, p. 267, pl. XIII, fig, 14, 1823.
Lampsilis ventricosus SIMPSON, Synopsis, p. 526, 1900.

Range.— Entire Mississippi drainage, the St. Lawrence system, southern drainage into Hudson Bay.

Lake Winnipeg; Battle River, Manitoba, and north to Nelson River! and its tributaries, in north latitude 57°.

Lampsilis luteolus Lamarck.

Unio luteola LAMARCK, Anim. s. Vert., VI, p. 79, 1819.—SOWERBY, Conch. Icon., XVI, Mon. *Unio*, pl. LVIII, figs. 293, *a–b*, 1867.
Lampsilis luteolus SIMPSON, Synopsis, p. 534, 1900.

Range. — Entire Mississippi drainage and southwest to the Brazos River, Texas; entire Dominion of Canada east of the Rocky Mountains and north to the Red River of the North!

Lake Winnipeg! Lower Saskatchewan! Battle River, Manitoba. Hill River, Keewatin! (var. *superiorensis* Marsh). Great Slave Lake! Lake Athabaska! Moose Factory, James Bay! Manitoba Lake.

[1] Proceedings U. S. Nat. Museum, vol. XXII, pp. 501–1044, 1900. Separate paper No. 1205, with pp. i–viii prefixed.

Lampsilis borealis Gray.

Unio borealis GRAY, Ottawa Naturalist, 1882, p. 53, plate with three figures.
Lampsilis borealis (GRAY) SIMPSON, Synopsis, p. 535, 1900.

Range. — St. Lawrence drainage. Lake of the Woods! Ottawa, Ontario!

Lampsilis radiatus Gmelin.

Mya radiata GMELIN, Syst. Nat., VI, p. 3220, 1792.
Unio radiatus SPENGLER, Skr. Nat. Selsk, II, p. 3, 1792; III, p. 62, 1793. — CONRAD, Mon., II, p. 24, pl. x, fig. 2, 1836.
Lampsilis radiatus SIMPSON, Synopsis, p. 535, 1900.

Range. — St. Lawrence and Atlantic drainage, south to North Carolina. Manitoba.

Lake Winnipeg! Saskatchewan River! Nelson River drainage! Great Slave Lake (Kennicott)!

Lampsilis ligamentinus Lamarck.

Unio crassus SAY, Nicholson's Encycl., Am. ed., II, Art. Conchology, pl. I, fig. 8, 1817. Not *Unio crassus* Retzius, 1788.
Unio ligamentina LAMARCK, Anim. s. Vert., VI, p. 72, 1819. — KÜSTER, Conch. Cab., Mon. *Unio*, p. 23, pl. III, fig. 3, 1852.
Lampsilis ligamentinus SIMPSON, Synopsis, p. 539, 1900.

Range. — Mississippi drainage, irregularly distributed in the St. Lawrence drainage.

Roseau River and Millwood, Assiniboine River, Manitoba.

Lampsilis rectus Lamarck.

Unio recta LAMARCK, Anim. s. Vert., VI, p. 74, 1819.— KÜSTER, Conch. Cab., Mon. *Unio*, p. 35, pl. VI, fig. 1, 1852.
Lampsilis rectus SIMPSON, Synopsis, p. 544, 1900.

Range. — Entire drainage of the Mississippi and Alabama Rivers; St. Lawrence system, Red River of the North, Roseau and Assiniboine Rivers in Manitoba!

Lampsilis ellipsiformis Conrad.

Unio ellipsiformis CONRAD, Mon., VIII, p. 60, pl. XXXIV, fig. 1, 1836.
Unio spatulatus LEA (1845), Trans. Am. Phil. Soc., X, p. 80, pl. VIII, fig. 22, 1848.
Lampsilis ellipsiformis SIMPSON, Synopsis, p. 557, 1900.

Range. — Mississippi drainage north of Lat. 38°, St. Lawrence drainage, in part; Manitoba.

Red River of the North! Lake Winnipeg, Manitoba.

Lampsilis alatus Say.

Unio alatus SAY, Nicholson's Encycl., 1st Am. ed., Art. Conchology, II, pl. IV, fig. 2, 1817.—CONRAD, Mon., VII, p. 57, pl. XXXI, 1836.

Lampsilis (*Proptera*) *alatus* SIMPSON, Synopsis, p. 567, 1900.

Range. — Entire drainage of the St. Lawrence; of the Mississippi north of Arkansas; Alabama; Manitoba. Red River of the North!

Lampsilis gracilis Barnes.

Unio gracilis BARNES, Am. Journ. Sci., 1st ser., VI, p. 274, 1823.—SOWERBY, Conch. Icon., XVI, pl. XXXIX, fig. 215, 1866.
Lampsilis gracilis SIMPSON, Synopsis, p. 573, 1900.

Range. — Eastern Texas; Mississippi, and St. Lawrence drainage; Manitoba. Red River of the North!

Genus **Strophitus** Rafinesque.

Strophitus rugosus Swainson.

Anodon rugosus SWAINSON, Zool. Ill., 1st ser., II, pl. XCVI, 1822.
Alasmodonta edentula SAY, New Harmony, Diss., II, No. 22, p. 340, 1829.
Anodonta edentula FÉRUSSAC, Mag. de Zool., Guerin, 1835, p. 25.
Strophitus edentulus CONRAD, Proc. Acad. Nat. Sci. Phila., VI, p. 263, 1853.
Anodonta undulata HILDRETH, Am. Journ. Sci., XIV, p. 290, 1828.
Anodon areolatus SWAINSON, Zool. Ill., 2d ser., I, pl. XVIII, 1829.
Anodonta wardiana LEA (1836), Trans. Am. Phil. Soc., VI, p. 46, pl. XIV, fig. 42, 1838.
Anodonta tetragona LEA (1845), *op. cit.*, X, p. 82, pl. VIII, fig. 25, 1845.
Anodonta arkansasensis LEA, *op. cit.*, XI, p. 293, pl. XXIX, fig. 56, 1852.
Anodonta shæfferiana LEA, *op. cit.*, X, p. 288, pl. XXVI, fig. 50, 1852.
Anodonta showalteri LEA (1860), Journ. Acad. Nat. Sci. Phila., 1862, p. 215, pl. XXXIII, fig. 284, 1862.
Alasmodon rhombica ANTHONY, Am. Journ. Conch., I, p. 158, pl. 12, fig. 5, 1865.
Anodonta salmonea CLESSIN, Conch. Cab., Mon. *Anodonta*, p. 91, pl. XXIV, figs. 1–2, 1873.
Anodonta pavonia LEA.

Range. — St. Lawrence system; the whole of the Mississippi drainage, Texas, Alabama, the Atlantic drainage; Manitoba.

Red River of the North! Lake Winnipeg! Great Playgreen Lake! Saskatchewan River.

Genus **Anodonta** Lamarck.

Anodonta beringiana Middendorff.

Anodonta cellensis var. *beringiana* MIDD., Sib Reise, II, p. 284, pl. XXVIII, figs. 4–7, pl. XXIX, figs. 1–4, 1851.
Anodonta youconensis LEA, Proc. Acad. Nat. Sci. Phila., XI, p. 81, 1867.
Anodonta youkanensis LEA, Journ. Acad. Nat. Sci. Phila., n. s., VI, p. 287, pl. XL, fig. 99, 1868.

Range. — Drainage into Bering Sea from Asia and America; also Cook Inlet drainage.

Kenai Peninsula! Kuskokwim River near Redoubt Kolmakof! Yukon River below Anvik, in pools and quiet sloughs left by the

receding freshets! Avacha Bay, Kamchatka! Amur River! eastern Siberia and Mongolia.

Anodonta kennerleyi Lea.

Anodonta kennerleyi LEA, Proc. Acad. Nat. Sci. Phila., IV, p. 306, 1860; Journal, V, p. 108, pl. XVIII, fig. 256, 1862.

Range. — Puget Sound! British Columbia.

Anodonta oregonensis Lea.

Anodonta oregonensis LEA, Trans. Am. Phil. Soc., VI, p. 80, pl. XXI, fig. 67, 1838.
Margarita (Anodonta) oregonensis LEA, Synopsis, p. 30, 1837.
Anodonta cognata GOULD, Proc. Boston Soc. N. Hist., III, p. 294, 1850; Rep. on Moll. U. S. Expl. Exp., p. 435, pl. XXXVIII, figs. 546, *a–b*, 1852.

Range. — Northern California, Oregon and British Columbia; eastward to Great Salt Lake, Utah.

Vancouver Island, B. C., abundant near Victoria, and at Nootka; Sumas Lake, Fraser River valley, B. C. Shushwap Lake; Nicola Lake and Okanogan Lake, B. C.; Kadiak Island, Alaska (Fisher).

Anodonta nuttalliana Lea.

Anodonta nuttalliana LEA, Trans. Am. Phil. Soc., VI, p. 77, pl. XX, fig. 62, 1838.
Anodonta triangularis TRASK, Proc. Acad. Nat. Sci. Calif., I, p. 29, Feb. 19, 1855.
Anodon triangularis SOWERBY, Conch. Icon., XVII, pl. XXIX, fig. 56 *b*, 1870.

Range. — California in the Sacramento River, and northward to British Columbia, Nootka and Clayoquot Sound, Vancouver Island; Chilliwak Lake, Nicola Lake and Shushwap Lake, British Columbia.

Anodonta wahlamatensis Lea.

Anodonta wahlamatensis LEA, Trans. Am. Phil. Soc., VI, p. 78, pl. XX, fig. 64, 1838.
Anodonta rotundovata TRASK, Proc. Acad. Nat. Sci. Calif., I, p. 29, 1855.
Anodon rostratus SOWERBY, Conch. Icon., XVII, pl. II, fig. 4, 1872.
Anodonta laosensis FISCHER, Bull. Soc. N. Hist., d'Autun, p. 219, 1891.
Anodonta rotundata SIMPSON, Synopsis, p. 629, in synonymy, 1900, not of Trask.

Range. — Utah and westward, California to British Columbia in the Pacific.

Nootka, Vancouver Island; Sumas Lake and Prairie, Fraser River valley, British Columbia.

Anodonta marginata Say.

Anodonta marginata SAY, Nicholson's Encyclop., 1st Am. ed., II, Art. Conchology, p. 19, pl. III, fig. 5, 1817.

Anodonta fragilis LAMARCK, Anim. s. Vert., VI, p. 85, 1819.—DELESSERT, Réc. Coq. Lam., pl. XIII, figs. 2 *a*, 2 *b*, 1841.
Anodonta lacustris LEA, Proc. Acad. Nat. Sci. Phila., I, p. 84, 1857.
Anodonta flava, pallida, glandulosa and *irisans* ANTHONY, Am. Journ. Conch., I, pp. 161–3, pl. XIV–XVI, 1865.
Anodonta subcarinata CURRIER, Am. Journ. Conch., III, p. 113, pl. VI, fig. 5, 1867.
Anodon exilis SOWERBY, Conch. Icon., XVII, pl. XXII, fig. 84, 1869.

Range. — Drainage of the St. Lawrence River basin, including the lakes.

Anticosti Island, in lake near Becsia River, six miles inland! Battle Creek, Manitoba!

Anodonta implicata Say.

Anodonta implicata SAY, New Harmony, Diss., II, No. 22, p. 340, 1822.— CLESSIN, Conch. Cab., ed. II, *Anodonta*, p. 78, pl. XIX, fig. 3, 1873.
Anodonta newtonensis LEA, Trans. Am. Phil. Soc., VI, p. 79, pl. XXI, fig. 66, 1838.
Anodonta housatonica LINSLEY, Am. Journ. Sci., 1845, p. 277.

Range. — Atlantic drainage from Virginia northward, St. Lawrence drainage, Saskatchewan basin.

Manitoba in Lake Winnipeg! and Souris River; lower Saskatchewan River!

Anodonta grandis Say.

Anodonta grandis SAY, New Harmony, Diss., II, p. 341, 1829. — CLESSIN, Mon. Anod. in Conch. Cab., n. ed., p. 96, pl. XXX, figs. 1–2, 1873.
Anodonta ovata LEA, Trans. Am. Phil. Soc., VI, p. 2, pl. II, fig. 2, 1838.
Anodonta salmonea LEA (pathologic), Trans. Am. Phil. Soc., VI, p. 45, pl. XIV, fig. 41, 1838.
Anodonta lewisii LEA, Journ. Acad. Nat. Sci. Phila., IV, p. 362, pl. LXII, fig. 187, 1860.
Anodonta footiana LEA, Trans. Am. Phil. Soc., VIII, p. 225, pl. XX, fig. 44, 1842.
Anodonta marryattiana LEA, *op. cit.*, p. 226, pl. XX, fig. 45, 1842.
Anodonta gigantea LEA, Trans. Am. Phil. Soc. 1834, p. 1, pl. I, fig. 1 (pathologic?).
Anodonta grandis SIMPSON, Synopsis Naiades, pp. 641–644, 1900 (with many synonyms).

Range. — Entire Mississippi system and southwest to Texas; upper St. Lawrence drainage; Manitoba.

Red River of the North! Shoal Lake; Souris River! Fairford River! and Lake Winnipeg, Manitoba!

Variety *footiana* Lea: Souris River, Manitoba! Nipegon River, Lake Hannah.

Variety *gigantea* Lea: Manitoba.

This variable and widely extended species is responsible for many synonyms cited by Mr. Simpson. It appears that the Manitoba and

perhaps the upper St. Lawrence localities may owe its presence to capture of part of the Mississippi drainage, owing to changes of level, elsewhere referred to.

Anodonta kennicotti Lea.

Anodonta kennicotti LEA, Proc. Acad. Nat. Sci. Phila., V, p. 56, 1861 ; Journal, n. s., V, p. 214, pl. XXXIII, fig. 283, 1862.
Anodonta simpsoniana LEA, *op. cit.*, p. 56, 1861 ; p. 212, pl. XXXII, fig. 281, 1862.
Anodonta dallasiana LEA, Proc. Acad. Nat. Sci. Phila., VII, p. 190, 1863 ; Journal, VI, p. 29, pl. XI, fig. 28, 1866.

Range. — Upper and middle St. Lawrence system. Mackenzie drainage to Great Slave Lake.

Lake of the Woods ; Manitoba Lake ; Lake Winnipeg ! Grand Rapids of the Saskatchewan ! Ekwan River, Keewatin ; Fort Simpson, Mackenzie River ! Fort Erie and Fort Rae ! Great Slave Lake ; Buffalo Lake, Methy Portage, Saskatchewan.

This is the most characteristic Naiad of the central Boreal region and reaches perhaps farther north (Lat. 63°) than any other species in American waters.

Anodonta pepiniana Lea.

Anodonta pepiniana LEA, Trans. Am. Phil. Soc., VI, p. 96, pl. XVI, fig. 51, 1838.

Range. — Upper and middle St. Lawrence drainage, Saskatchewan basin.

Lake Winnipeg ! Manitoba. Attawapiskat River, eastern Keewatin.

Genus **Gonidea** Conrad.

Gonidea angulata Lea.

Anodonta angulata LEA, Trans. Am. Phil. Soc., VI, p. 97, pl. XVI, fig. 52, 1838.
Anodon feminalis GOULD, Proc. Boston Soc. N. Hist., III, p. 293, 1850 ; Moll. U. S. Expl. Exp., p. 436, pl. XXXVIII, figs. 547, *a–b*, 1852.
Anodonta randalli TRASK, Proc. Acad. Nat. Sciences Calif., I, p. 28, 1855.
Anodon biangulata SOWERBY, Conch. Icon., XVII, pl. XXIII, figs. 8, *a–b*, 1869.

Range. — Central California, north to British Columbia and eastward to Idaho.

Columbia River near Fort Colville !

This singular shell hardly more than crosses the boundary, so far as reported. According to Stearns and Hemphill this species buries itself obliquely in the rather hard bed of rapid streams, so that the flattened posterior portion lies horizontally even with the bottom, and offers no resistance to the current. Whether the flattening and consequent angulation of the valves is a modification due to the burrowing habit and the influence of its environment, or not, cannot yet be positively stated.

Genus **Anodontoides** Simpson.

Anodontoides ferussacianus Lea.

Anodonta ferussaciana LEA, Trans. Am. Phil. Soc., v, p. 45, pl. VI, fig. 15, 1834.
Anodonta buchanensis LEA, *op. cit.*, p. 47, pl. XIV, fig. 43, 1838.
Anodonta argentea LEA, *op. cit.*, VIII, p. 223, pl. XIX, fig. 41, 1842.
Anodonta ferruginea LEA, *op. cit.*, VIII, p. 225, pl. XIX, fig. 43, 1842.
Anodonta plicata HALDEMAN, Journ. Acad. Nat. Sci. Phila., VIII, p. 201, 1842.
Anodonta denigrata LEA, Trans. Am. Phil. Soc., x, p. 285, pl. XXV, fig. 45, 1852.
Anodonta oblita LEA, *op. cit.*, p. 46, pl. XXVIII, fig. 52, 1852.
Anodonta subcylindracea LEA, *op. cit.*, VI, p. 106, pl. XXIV, fig. 117, 1838.
Anodonta modesta LEA, Journ. Acad. Nat. Sci. Phila., n. s., IV, p. 364, pl. LXIII, fig. 189, 1860.

Range. — Mississippi drainage, St. Lawrence, Red River of the North, and Saskatchewan basins.

Lake Winnipeg! Lake of the Woods!

Genus **Symphynota** Lea.

Subgenus **Lasmigona** Rafinesque.

Symphynota costata Rafinesque.

Alasmidonta costata RAFINESQUE, Ann. Gen. Sci. Brux., v, p. 318, pl. LXXXII, figs. 15, 16, 1820.
Alasmodonta rugosa BARNES, Am. Journ. Sci., VI, p. 278, pl. XIII, fig. 21, 1823.

Range. — Mississippi and St. Lawrence basins.

Manitoba in Roseau River!

Subgenus **Pterosygna** Rafinesque.

Symphynota complanata Barnes.

Alasmodonta complanata BARNES, Am. Journ. Sci., VI, p. 278, pl. XIII, fig. 22, 1823. — BAKER, Moll. Chicago Area, I, p. 60, pl. VIII, figs. 1–2, pl. IX, figs. 1–4, 1898.
Complanaria gigas SOWERBY, Conch. Manual, fig. 141, 1839; 2d ed., p. 115, fig. 141, 1842.
Unio katherinæ LEA, Synopsis, p. 35, 1838; Trans. Am. Phil. Soc., VI, p. 143, 1839. Lake Superior.

Range. — Mississippi drainage north of Arkansas on the west and Tennessee on the east; Upper St. Lawrence and its tributaries. The variety *katherinæ* northward from Lake Superior to the Mackenzie and Keewatin.

Lake Winnipeg! Shell River and Lower Saskatchewan! Nelson River drainage; Assiniboine River; Red River of the North! Battle River, Manitoba.

Genus **Margaritana** Schumacher.

Margaritana margaritifera Linné.

Typical form:

Mya margaritifera LINNÉ, Syst. Nat., ed. x, p. 671, 1758, Conch. Cab., VI, pl. I, fig. 5.
Alasmodonta arcuata BARNES, Am. Journ. Sci., VI, p. 277, pl. XII, fig. 20, 1823.
Unio elongatus LAMARCK, Anim. s. Vert., VI, p. 70, 1819.
Unio sinuata C. PFEIFFER, 1825; + *U. roissyi* Michaud, 1831; + *U. tristis* Morelet, 1845; + *U. crassissimus* (Klein) Lea, 1836.
Unio (*Alasmodonta*) *dahuricus* MIDDENDORFF (1850), Sib. Reise, II, p. 275, pl. XXVI, figs. 3–5, 1851.
Unio complanatus MIDDENDORFF, Sib. Reise, II, p. 273, pl. XXVII, figs. 1–6, 1851.
Unio mongolicus, MIDDENDORFF, Sib. Reise, II, p. 277, pl. XXVII, figs. 7–8, 1851.
Margaritana margaritifera SIMPSON, Synopsis, pp. 674–677 (*ex parte*), 1900.

Margaritana margaritifera variety **falcata** Gould.

Alasmodon falcata GOULD, Proc. Boston Soc. N. Hist., III, p. 294, Nov., 1850; Wilkes' Expl. Exp. Moll., p. 433, figs. 545, *a–b*, 1852.
Unio falcatus SOWERBY, Conch. Icon., XVI, Mon. *Unio*, pl. LXXV, fig. 390, 1868.
Alasmodon yubaënsis TRASK, Proc. Calif. Acad. Sci., I, p. 30, 1855.

Range of the type. — The whole of northern Europe and western Siberia. In northeastern Asia from the Upper Amur basin and southern Mongolia, Kamchatka, and Sakhalin Island. In America on Anticosti Island; Quebec Province, eastern Canada; New England and New York. Also, isolated from the eastern area by a wide gap, in the Lower Saskatchewan near Lake Winnipeg.

Range of the variety. — California, in the Sierra, Plumas Co., at 7,400 feet above the sea! Sacramento River; Yuba River; Oregon; Washington at Wallawalla; northwestern Montana in the headwaters of the Missouri! (only) above Fort Benton, but not reported lower down; Victoria and Nanaimo! Vancouver Island; Fraser River; Kakwous Lake (4,000 feet elevation) and streams in Lat. 50°, British Columbia; Naha Bay, Alaska, abundant near sea level in small lake, Lat. 55°35 North!

The most obvious distinction between the typical form and variety *falcata* lies in the purple nacre of the latter, which is often extremely rich and beautiful, though in old cabinet specimens usually much faded. The specimens above the falls in the headwaters of the Missouri may have been captured with streams by orographic changes, or transported in the glochidium stage attached to fishes; at any rate

they are of the Pacific type, and are not found below the site of Fort Benton, so far as yet reported. It is quite evident that much scientific interest attaches to a thorough knowledge of the distribution of this species, with its possible relation to geologic changes and the results of glaciation. It is to be hoped that any data bearing on this matter will be carefully preserved and put on record by travelers and others in these regions.

Genus **Unio** Retzius.

Unio complanatus Solander.

Mya complanata SOLANDER (after Lister, t. 150, fig. 5), in Cat. Portland Museum, p. 100, No. 2190, 1786. — DILLWYN, Descr. Cat. Rec. Sh., I, p. 51, 1817.
Unio complanatus SIMPSON, Synopsis, pp. 720–5, 1900.

Range. — Atlantic drainage from Georgia to the St. Lawrence system. Also in the Saskatchewan River.

North shore of Lake Superior; Lake Nipissing, etc.

Genus **Quadrula** Rafinesque.

Quadrula plicata Say.

Unio plicata SAY, Nicholson's Encycl., 1st Am. ed., Art. Conch., pl. III, fig. 1, 1817.
Unio crassus BARNES, Am. Journ. Sci., VI, p. 118, 1823.
Quadrula plicata SIMPSON, Synopsis, p. 767, 1900.
Unio hippopæus LEA, Proc. Am. Phil. Soc., IV, p. 163, 1845 (variety).

Range. — Mississippi drainage from Arkansas and Tennessee northward; Western Michigan, Red River of the North, Lake Winnipeg and the Saskatchewan.

The variety *hippopæa* occurs in Lakes Erie, Michigan, and Winnipeg.

Quadrula undulata Barnes.

Unio undulata BARNES, Am. Journ. Sci., VI, p. 120, pl. II, 1823.
Unio costatus SAY, Am. Conch., VI, No. 41, 1834; not of Rafinesque.
Quadrula undulata SIMPSON, Synopsis, p. 769, 1900.

Range. — Mississippi and St. Lawrence drainage generally, Texas and Alabama; Red River of the North; Lake Winnipeg; the Saskatchewan River.

Quadrula heros Say.

Unio heros SAY, New Harmony Diss., II, No. 19, p. 291, 1829.—CONRAD, Mon., XII, p. 107, pl. LIX, 1840.
Unio multiplicatus LEA, Trans. Am. Phil. Soc., IV, p. 70, pl. IV, fig. 2, 1831.

Range. — Nuevo Leon, Mexico; Tombigbee River, Alabama. The Mississippi system generally; Red River of the North, Manitoba.

Quadrula lachrymosa Lea.

Unio lachrymosus LEA, Trans. Am. Phil. Soc., III, p. 272, pl. VI, fig. 8, 1827.
Unio asperrimus LEA, *op. cit.*, IV, p. 71, pl. V, fig. 3, 1831.
Unio quadrulus SAY, Am. Conch., VI, pl. LIII, 1834 ; not of Rafinesque.
Quadrula lachrymosa SIMPSON, Synopsis, p. 776, 1900.

Range. — Entire Mississippi drainage ; various localities in the St. Lawrence system ; Red River of the North, Manitoba, abundant.

Quadrula rubiginosa Lea.

Unio rubiginosus LEA, Trans. Am. Phil. Soc., III, p. 427, pl. VIII, fig. 10, 1829.
Unio flavus CONRAD, 1834. — SAY, Am. Conch., VI, 1834. — CONRAD, Mon., IX, p. 74, pl. XII, fig. 2, 1837.
Unio trigonus SOWERBY, Conch. Icon., Mon. *Unio*, XVI, pl. LXIV, fig. 322, 1868.
Quadrula rubiginosa SIMPSON, Synopsis, p. 786, 1900.

Range. — Entire Mississippi drainage ; eastern Texas ; St. Lawrence drainage ; Red River of the North ! Manitoba ; Nelson River ! Keewatin ; Red and Roseau Rivers and Lake Winnipeg, Manitoba.

Family SPHÆRIIDÆ.

This family is reviewed in Trans. Wagner Institute, vol. III, part VI, pp. 1439–60, and a summary of the arrangement adopted is also given in Proceedings Biological Society of Washington, XVI, pp. 5–8, 1903. This arrangement in effect is that which is adopted on the present occasion. The specific synonymy is mainly due to the late Temple Prime, who kindly named the Alaskan specimens collected previous to his death. Some later arrivals have been examined by Dr. Sterki. I have seen no specimens or figures of the species from Port Clarence named by Westerlund, and they are introduced on his authority. It is probable that a considerable reduction will eventually be had in the number of nominal species, especially of *Corneocyclas*.

Genus **Sphærium** Scopoli.

Subgenus **Sphærium** s. s.

Sphærium simile Say.

Cyclas similis SAY, Nicholson's Encycl., 1st Am. ed., pl. I, fig. 9, 1817.
Cyclas sulcata LAMARCK, Anim. s. Vert., V, p. 560, 1818.
Sphærium sulcatum PRIME, Mon. Am. Corbic., p. 33, fig. 25, 1865.

Range. — United States, east of the Mississippi River ; Canada ; Manitoba.

Lake Superior ; Red River of the North ; Lake Winnipeg ; Pine

Creek and Fort Pelly, Manitoba; Lower Saskatchewan River at Grand Rapids!

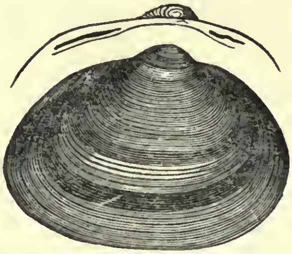


FIG. 97. *Sphærium simile* Say.

This species is the *Cyclas saratogea* of Lamarck and has numerous other synonyms. It is the largest species of the group in North America, but, judging by the records, rather irregularly distributed. The Lamarckian locality is Lake George; Say's specimens are from the vicinity of Philadelphia.

Sphærium striatinum Lamarck.

Cyclas striatina LAMARCK, Anim. s. Vert., v, p. 560, 1818.
Sphærium striatinum PRIME, Mon. Am. Corbic, p. 37, fig. 29, 1865.

Range. — North America generally, east of the Sierra Nevada Mountains, from Alabama to the Upper Mackenzie.

Hell Gate River (Columbia drainage), Montana; Humboldt River, Nevada (Hepburn); in Manitoba at Lake Winnipeg; Great Playgreen Lake; York Factory, Keewatin; Pasqua Lake, Assiniboia! Saskatchewan River at Grand Rapids! Mackenzie River at old Fort Simpson!

FIG. 98. *Sphærium striatinum.*

So far as the records indicate, the place of this species is east of the Rockies, but in at least two places it has been transferred to the head-waters of streams flowing westward. In the East it is perhaps the most common of the *Sphæria*, taking much such a place as *S. corneum* does in the European fauna.

* **Sphærium aureum** Prime.

Cyclas aurea PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 159, 1851.
Sphærium aureum PRIME, Mon. Am. Corbic, p. 35, fig. 26, 1865.

Range. — Lake Superior.

It is probable that this species crosses the line into Canada, though not yet searched for in that region.

FIG. 99. *Sphærium aureum.*

Sphærium walkeri Sterki.

Sphærium walkeri STERKI, Nautilus, XIV, p. 142, April, 1901.

Range. — Frances Lake and Finlayson Lake, Yukon District, Liard River drainage (Dawson); Lake Michigan, 12 fathoms (Walker).

Identified by Dr. Sterki, a species related to *rhomboideum* and *occidentale*, but yet unfigured.

Sphærium solidulum Prime.

Cyclas solidula PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 158, 1851.
Sphærium solidulum PRIME, Mon. Am. Corbic., p. 36, fig. 27, 1865.

Range. — Eastern United States, from New Mexico and Louisiana to the Great Lakes, and Manitoba.

In Manitoba, at Winnipeg, Brandon, and the Red River of the North; in Alberta, at Egg Lake.

Sphærium stamineum Conrad.

Cyclas staminea CONRAD, Am. Journ. Sci., XXV, p. 342, pl. 1, fig. 5, 1834.
Sphærium stamineum PRICE, Mon. Am. Corbic., p. 38, fig. 30, 1865.

FIG. 100. *Sphærium stamineum* Conrad.

Range. — Eastern United States, northward to Manitoba.

Manitoba (Hanham).

The type locality for this species is Alabama. In 1865 Mr. Prime united with it the *Cyclas fuscata* of Rafinesque (Ohio) and the *C. bulbosa* Anthony from Arkansas. Later collectors have found it widely distributed over the eastern portion of the continent.

Sphærium rhomboideum Say.

Cyclas rhomboida SAY, Journ. Acad. Nat. Sci. Phila., II, p. 380, 1822.
Cyclas elegans ADAMS, Boston Journ. Nat. Hist., III, p. 330, pl. III, fig. 11, 1840.
Sphærium rhomboideum PRIME, Mon. Am. Corbic., p. 39, fig. 31, 1865.

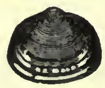


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FIG. 101. *Sphærium rhomboideum* Say.
FIG. 102. *Sphærium dentatum* Hald.
FIG. 103. *Sphærium fabale* Prime.

Range. — New England to Michigan, and northwestward.

Lake Superior; Manitoba at Pine Creek and in Lake Winnipeg.

Left bank of the Yukon River, Alaska, 30 miles below the mouth of the Tanana! In duck's crop at Pender Island, British Columbia.

This attractive species is apparently sporadic or local in its habitats, but if intelligently sought for would probably be found more often. It is not yet positively known from British Columbia, but there is little reason to doubt it will be found there when the fauna is better known. So far it seems to be rather rare everywhere.

* **Sphærium dentatum** Haldeman. Figure 102.

Cyclas dentata HALDEMAN, Proc. Acad. Nat. Sci. Phila., I, p. 100, 1841, Willamette River, Oregon.
Sphærium dentatum PRIME, Mon. Am. Corbic., p. 40, fig. 32, 1865.

Range. — California and Oregon. Spokane Falls, Washington.

Sphærium fabale Prime. Figure 103.

Cyclas fabalis PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 159, 1851.
Sphærium fabalis PRIME, Mon. Am. Corbic., p. 40, fig. 33, 1865.

Range. — Eastern United States and northward, Battle River, Alberta.

This species was originally described from specimens collected in Lake Superior by Louis Agassiz, but has since been recognized from Georgia, Virginia and Tennessee. It is remarkable for its compressed form and inconspicuous beaks.

Sphærium occidentale Prime.

Cyclas ovalis PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 276, 1852, not of Férussac, 1807.
Sphærium occidentale PRIME, Proc. Acad. Nat. Sci. Phila., for 1860, p. 295; Mon. Am. Corbic., p. 41, fig. 34, 1865.

Range. — Northern United States, Vermont to Washington and northward.

Hell Gate River (Columbia drainage), Montana! Lower Saskatchewan River, near Lake Winnipeg; Spokane Falls, Wash.

FIG. 104. *Sphærium occidentale.*

***Sphærium nobile** Gould.

Cyclas nobilis GOULD, Proc. Boston Soc. Nat. Hist., V, p. 229, 1855; San Pedro, Cal.
Sphærium nobile PRIME, Mon. Am. Corbic., p. 41, fig. 35, 1865.

Range. — California, Washington, Idaho.

Blackfoot River, Idaho! Seattle, Wash.

This is not figured by Gould in Expedition Shells, as stated by Prime. It closely resembles *S. dentatum* Hald., but is less inflated, while the young are smooth.

Sphærium patella Gould.

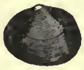

FIG. 105. *Sphærium patella.*

Cyclas patella GOULD, Proc. Boston Soc. Nat. Hist., III, p. 292, 1850; U. S. Expl. Exped. Moll., p. 426, pl. XXXVI, figs. 527, *a–b*, 1852.
Sphærium patella PRIME, Mon. Am. Corbic., p. 42, fig. 36, 1865.

Range. — Northern California to British Columbia.

Healdsburg, Calif.! Wallawalla, Vancouver and Seattle, Wash.; Nanaimo, and in duck's crop at Pender Island! British Columbia.

Sphærium emarginatum Prime.

Cyclas emarginata PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 156, 1851.
Sphærium emarginatum PRIME, Mon. Am. Corbic., p. 43, fig. 38, 1865.

Range. — Lake Superior; Saskatchewan River at Grand Rapids, near Lake Winnipeg!

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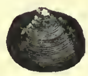

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FIG. 106. *Sphærium emarginatum* Prime.
FIG. 107. *Sphærium flavum* Prime.

* **Sphærium flavum** Prime.

Cyclas flava PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 155, 1851.
Sphærium flavum PRIME, Mon. Am. Corbic., p. 43, fig. 39, 1865.

Range. — Lake Superior; Sault Ste. Marie, Mich.

Sphærium tumidum Baird.

Sphærium tumidum BAIRD, Proc. Zool. Soc. London, 1863, p. 69. — PRIME, Mon. Am. Corbic., p. 44, 1865.

Range. — Sumas Prairie, Fraser River valley, British Columbia. This species appears not to have been figured or subsequently recognized by collectors.

Sphærium spokani Baird.

Sphærium spokani BAIRD, Proc. Zool. Soc. London, for 1863, p. 69. — PRIME, Mon. Am. Corbic., p. 44, 1865.

Range. — Spokane and Kootenai Rivers, eastern British Columbia. Unfigured, and not recognized by later collectors.

Sphærium (Musculium) raymondi Cooper.

Sphærium raymondi J. G. COOPER, Proc. Acad. Sci. Calif., 2d series, III, p. 74, pl. I, figs. 1–8, 1890.

Primella raymondi COOPER, *op. cit.*, p. 82.
Sphærium cooperianum PRIME, Cat. Corbic., Am. Journ. Conch., V, p. 152, 1869, nude name.

Range. — Alpine region of the Sierra Nevada, Calif., to 8,700 feet; Seattle, Spokane Falls, and Chehalis River, Wash.; Idaho; Vancouver Island, British Columbia (Roper).

Sphærium (Musculium) partumeium Say.

Cyclas partumeia SAY, Journ. Acad. Nat. Sci. Phila., II, p. 380, 1822.
Sphærium partumeium PRIME, Mon. Am. Corbic., p. 45, fig. 42, 1865.

Range. — United States from Nebraska eastward, south to the Gulf of Mexico and north to Manitoba.

Sphærium (Musculium) jayanum Prime.

Cyclas jayensis PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 157, 1851.
Sphærium jayanum PRIME, Mon. Am. Corbic., p. 46, fig. 43, 1865.

Range. — Northern United States from Iowa eastward, Canada, and northward.

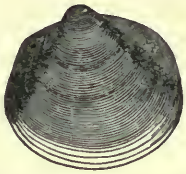

FIG. 108. *Sphærium jayanum* Prime.

Lake Superior; Fort Ellice, Manitoba; in Alberta at McLeod, Olds, Crow Lodge Creek, and Little Bow River.

Sphærium (Musculium) tenue Prime. Figure 109.

Cyclas tenuis PRIME, Proc. Boston Soc. Nat. Hist., p. 161, 1851. Androscoggin River, Maine.
Sphærium tenue PRIME, Mon. Am. Corbic., p. 47, fig. 44, 1865.

Range. — Maine, Canada, British America and northern Alaska.

Souris River, Manitoba; Saskatchewan River at Grand Rapids; Upper Mackenzie River at old Fort Simpson! left bank of the Yukon, thirty miles below the Tanana River mouth, Alaska!

Sphærium (Musculium) transversum Say. Figure 110.

Cyclas transversa SAY, New Harm. Disseminator, II, p. 356, 1829.
Sphærium transversum PRIME, Mon. Am. Corbic., p. 48, fig. 45, 1865.

Range.—United States east of the Rocky Mountains and northward to Canada and Manitoba.

Stomach of sturgeon, Great Playgreen Lake, Keewatin, N. Lat. 54°.

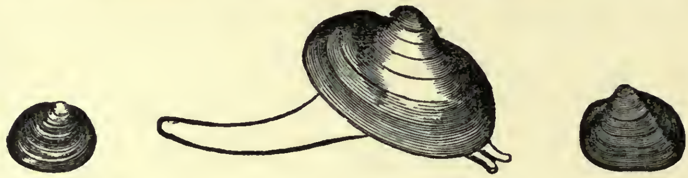

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FIG. 109. *Sphærium tenue.*
FIG. 110. *Sphærium transversum* Say, with foot and siphons extended.
FIG. 111. *Sphærium lenticula.*

Sphærium (Musculium) truncatum Linsley.

Cyclas truncata LINSLEY, Am. Journ. Sci., VI, p. 234, fig. 3, 1848.
Sphærium truncatum PRIME, Mon. Am. Corbic., p. 51, fig. 50, 1865.

Range. — Eastern United States from Colorado to Maine, south to the Ohio River and northward to Athabaska.

Methy Lake, Athabaska (Richardson).

This species is quite similar to the European *Cyclas calyculata*, type of the subgenus, and was mistaken for it by C. B. Adams in 1841.

Sphærium (Musculium) lenticula Gould.

Sphærium lenticula (GOULD, MS.) PRIME, Proc. Acad. Nat. Sci. Phila., for 1860, p. 36 (syn. exclus.).
Sphærium lenticula (GOULD) PRIME, Mon. Am. Corbic., p. 51, fig. 51, (syn. exclus.), 1865.

Range. — Carson and Klamath Rivers, California; Nanaimo, Vancouver Island, British Columbia.

This species, named in MS. by Dr. Gould and described by Prime, is not the same as the *Lucina lenticula* Gould, described from Patagonia in the Mollusca of the Exploring Expedition. The latter, by an engraver's error, was called on the plate (but not in the text) *Cyclas lenticula*, and this seems to have misled Mr. Prime, who may not have had access to the text of this rare volume.

* **Sphærium stagnicola** J. de C. Sowerby.

Cyclas stagnicola SOWERBY, in Richardson, Fauna Bor. Am., III, p. 316, 1836, Methy Lake, Athabaska.

* **Sphærium medium** J. de C. Sowerby.

Cyclas media SOWERBY, *op. cit.*, Methy Lake, Athabaska.

The two names above cited from Sowerby are not described in Richardson's work and I am unable to find any other reference to them in the literature. I presume they are undescribed.

*** Sphærium primeanum** Clessin.

Sphærium primeanum Clessin, Malak. Blätt., xxv, p. 122, pl. v, figs. 1, *a–b*, 1878.

Range. — Portland, Oregon; Seattle, Wash.

This species, which has a remarkable resemblance to a *Bornia*, judging by the figure, is not otherwise known to me, but, if the localities given are correct, may also extend to British Columbia. According to Roper it closely resembles *S. rhomboideum* Say.

Genus **Corneocyclas** Férussac.

(+ *Pisidium* C. Pfeiffer.)

Corneocyclas (Phymesoda) virginica Gmelin.

Tellina virginica Gmelin, Syst. Nat., vi, p. 3236, 1792; based on Lister, Conch., pl. clix, fig. 15, from Virginia.
Cyclas dubia Say, Nicholson's Encycl., 1st Am. ed., pl. 1, fig. 10, 1817.
Phymesoda dubia (Say) Rafinesque, Ann. Gen. Sci. Phys., v, p. 319, 1820.
Pisidium virginicum Bourguignat, Amen. Mal., 1, p. 53, 1853. — Prime, Mon. Am. Corbic., p. 61, figs. 61, 62, 1865.

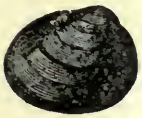

Fig. 112. *Corneocyclas virginica.*

Range. — United States, east of the Rocky Mountains, northward to British America and Alaska.

Lake of the Woods; Manitoba; Yukon River, Alaska, thirty miles below the Tanana River mouth! also at Nulato! and the Mission! Lake Superior, near St. Ignace Id., in 8 to 13 fathoms (S. I. Smith).

Corneocyclas (Phymesoda?) idahoënsis Roper.

Pisidium idahoënse Roper, Nautilus, iv, p. 85, Dec., 1896.

Range. — Old Mission, northern Idaho (Hemphill); Seattle, Wash. Stewart River, Yukon District, Dawson (*fide* Sterki).

Corneocyclas (Phymesoda) scutellata Sterki.

Pisidium scutellatum Sterki, Nautilus, x, p. 66, Oct., 1890.

Range. — Lake Michigan to Montana; Lake Patten, Wash., Pine Lake, Mich.; Orchard Lake, Minn.; Sheldon, Montana; Frances Lake, Liard River, Yukon District (*fide* Sterki), collected by Dawson in 1887.

Corneocyclas æquilateralis Prime.

Pisidium æquilaterale Prime, Boston Journ. Nat. Hist., vi, p. 366, pl. xii, figs. 23–25, 1852; Mon. Am. Corbic., p. 63, figs. 65–66, 1865.

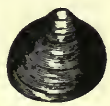

Fig. 113. *Pisidium æquilaterale* Prime.

Range. — Maine to Michigan, northward and westward to Alaska.

Kotzebue Sound, Alaska! in marl associated with mammoth bones, at Elephant Point. Bering Island, Bering Sea!

The specimens above referred to were identified for me by Mr. Prime.

Corneocyclas (Cymatocyclas) compressa Prime.

Pisidium compressum PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 164, 1851; Mon. Am. Corbic., p. 64, figs. 67–68, 1865.

Range. — Maine to California; Canada, the Yukon.

Lake Superior, near Ignace Id., in 4–6 fathoms; White Pine, Nevada; Sierra Nevada to 9,000 feet near Summit, Calif.; Ventura Co., Calif.; Vancouver Island, British Columbia (Raymond); Green Lake, Seattle, Wash.; Stewart River, Yukon District (*fide* Sterki).

FIG. 114. *Corneocyclas variabilis* Prime.

Corneocyclas variabilis Prime.

Pisidium variabile PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 163, 1851; Mon. Am. Corbic., p. 66, figs. 69, 70, 1865.

Range. — Eastern United States, north of Virginia; Colorado, and northward; Seattle, Wash.

Pine Creek, Manitoba; Stewart River, Yukon District (*fide* Sterki).

Corneocyclas abdita Haldeman.

Pisidium abditum HALDEMAN, Proc. Acad. Nat. Sci. Phila., I, p. 53, 1841.— PRIME, Mon. Am. Corbic., p. 68, figs. 72, 73, 1865.

Range. — North America, from Honduras northward to Alaska.

Marl Lake, Anticosti! Lake Superior in 4 to 13 fathoms near Ignace Island; Manitoba; Assiniboia at Qu'Appelle! Alberta, at Laggan, Red Deer, Olds, McLeod, Battle River, up to 5,200 feet elevation; east slope of the Sierra Nevada up to 7,100 feet; in Colorado up to 9,300 feet; west slope of the Sierra below 5,300 feet in California; Seattle, Wash.; in Alaska at Seldovia, Cook Inlet! Coal Harbor! Unga Island, Shumagins, in small pools on the tundra; Akun Island! Aleutians; the Yukon River, 30 miles below the mouth of the Tanana! and Bering Island, Bering Sea!

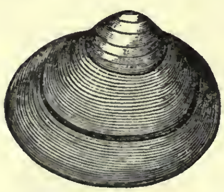

FIG. 115. *Corneocyclas abdita* Hald.

This is the most common and widespread species, out of the varieties of which many nominal species have been made.

*** Corneocyclas abyssorum** Stimpson.

Pisidium (sp.) SMITH and VERRILL, Am. Journ. Sci., II, p. 448, Dec., 1871.
Pisidium abyssomus (STM.) HOY, Trans. Wisconsin Acad. Sci., I, p. 100, 1872 (err. typ.).
Pisidium abditum var. *abyssorum* STIMPSON, S. I. Smith in Rep. U. S. Fish Com. for 1872–3, p. 704, 1874.
Pisidium abyssorum STERKI, Nautilus, XI, p. 124, March, 1898.

Range. — Deep water of the Great Lakes, and of the lake region of northern Michigan and Minnesota.

Lake Michigan; Lake Superior to a depth of 159 fathoms (food of *Coregonus*); Pine Lake, Mich.; Green Lake, Wisconsin.

This is another of the extra-limital species which search will probably reveal in Lake Winnipeg and other northern lakes.

FIG. 116. *Corneocyclas ventricosa.*

Corneocyclas ventricosa Prime.

Pisidium ventricosum PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 68, 1851; Mon. Am. Corbic., p. 72, figs. 79, 80, 1865.

Range. — Massachusetts, Canada, and northward to Great Slave Lake.

Corneocyclas rotundata Prime.

FIG. 117. *Corneocyclas rotundata.*

Pisidium rotundatum PRIME, Proc. Boston Soc. Nat. Hist., IV, p. 164, 1851; Mon. Am. Corbic., p. 72, figs. 81, 82, 1865.

Range. — Lake Superior region; Manitoba; St. Paul Island, Bering Sea!

Corneocyclas steenbuchii Möller.

Cyclas steenbuchii MÖLLER, Index Moll. Grönl., p. 20, 1842.
Pisidium steenbuchii MÖRCH, Am. Journ. Conch., IV, p. 37, 1868; *ibid.*, Rink's Greenland, App., p. 440, 1877.

Range. — Greenland, on the west coast! Iceland! Ungava, Labrador.

This species appears to be unfigured, but there are specimens in the Jeffreys collection from Iceland as well as Greenland. It appears to belong to the section *Cyclocalyx.*

Corneocyclas occidentalis Newcomb.

Pisidium occidentale NEWCOMB, Proc. Calif. Acad. Sci., II, p. 94, 1863. — PRIME, Mon. Am. Corbic., p. 73, 1865.

Range.—California to British Columbia.

East slope of Sierra Nevada, in California, to 9,700 feet. Nanaimo, Vancouver Island, British Columbia; Spokane Falls, Wash.

This unfigured species has been regarded by Roper as only a mutation of *C. abdita* Haldeman.

Corneocyclas ultramontana Prime.

Pisidium ultramontanum PRIME, Mon. Am. Corbic., p. 75, fig. 85, 1865.

Range. — Canoe Creek, California; Seattle, Wash.; Nanaimo, Vancouver Island, and Pender Island! British Columbia.

FIG. 118. *Corneocyclas ultramontana* Prime.

Corneocyclas arctica Westerlund.

Pisidium arcticum WESTERLUND, Vega Exp. Vetens. Iakt., IV, p. 217, 1885.

Range. — Port Clarence, Alaska.

Corneocyclas nivalis Westerlund.

Pisidium nivale WESTERLUND, *op. cit.*, p. 218, 1885.

Range. — Port Clarence, Alaska.

Corneocyclas glacialis Westerlund.

Pisidium glaciale WESTERLUND, *op. cit.*, p. 218, 1885.

Range. — Port Clarence, Alaska.

* **Corneocyclas sibirica** Clessin.

Pisidium sibiricum CLESSIN, K. Svenska Vet. Ak. Förh., p. 70, fig. 23, 1877; Mon. *Pisidium*, Conch. Cab., ed. II, pl. VII, figs. 15–17, 1877.—WESTERLUND, Fauna Pal. Reg., VII, p. 23, 1890.

Range. — Western Siberia, on the Yenisei River to 60° 50′ N. Lat., ? Port Clarence, Alaska.

* **Corneocyclas borealis** Clessin.

Pisidium boreale CLESSIN, in Westerlund, Fauna Pal. Reg., VII, p. 32, 1890.

Range. — Western Siberia at Lusino. ? Port Clarence, Alaska.

The preceding five species are ascribed to Port Clarence on the authority of the literature solely. I have not seen specimens of any of them. I suspect that the *C. sibirica* and *borealis* reappear in the form of new species, among the three nominal species preceding them.

Corneocyclas pulchella Jenyns.

Cyclas pulchella JENYNS, Trans. Phil. Soc. Cambridge, 1832, p. 306, pl. X, figs., 1812; not of Deshayes, 1835, nor Gassies, 1849. — SOWERBY, in Richardson, Fauna Bor. Am., III, p. 316, 1836.

Range. — Middle and Northern Europe to 69° N. Lat. Arctic America?

Methy Lake, Athabaska (Richardson).

*** Corneocyclas randolphi** Roper.

Pisidium randolphi Roper, Nautilus, IX, p. 99, Dec., 1895.

Range. — Seattle, Washington.

This species is finely striated, very much like *C. abdita* in general form, but of a peculiar and unique greenish-yellow color. It may very likely extend into British Columbia.

Corneocyclas (Tropidocyclas) henslowana Sheppard.

Tellina henslowana Sheppard, Trans. Linn. Soc., XIV, p. 150, 1825.
Cyclas appendiculata (Leach MS.) Turton, Man., ed. I, p. 15, pl. XV, fig. 6, 1831. — Sowerby, in Richardson, Fauna Bor. Am., III, p. 316, 1836.
Pisidium henslowianum Jenyns, Mon. *Cyclas*, p. 20, pl. XXI, figs. 6, 7, 1832.

Range. — Europe north of the Alps; Canada; British America.

Hamilton Bay, Lake Ontario; Lake Superior to Lake Winnipeg (Richardson).

The record from Richardson was naturally thought to be a misidentification, but the recent discovery in Lake Ontario of undoubted specimens of this species, leads to the belief that Sowerby, who certainly should have known a common British species, may after all have been correct.

In closing the list of *Sphæriidæ* I may be allowed to observe that so large a part of it is derived from the literature, and not from the present examination of specimens, that I do not feel the confidence in the validity of all the species, or the correctness of all the identifications that I might have felt under other circumstances. Until the very numerous species which have been named among American Pisidia of late years, shall have been adequately illustrated and some knowledge gained of the range of variation in these minute forms, a healthy skepticism in regard to our population of this genus will doubtless continue to prevail among collectors of fresh water shells.

BIBLIOGRAPHY

Baird, W.

1863 Descriptions of some New Species collected at Vancouver Island and in British Columbia by J. K. Lord, Esq. Proc. Zool. Soc. London, 1863, pp. 66-71.

Baker, F. C.

1904 New American Lymnæas, II. Nautilus, XVII, No. 6, Oct., 1904, pp. 62-3.

Bell, Robert.

1859 On the Natural History of the Gulf of St. Lawrence and the distribution of the Mollusca of Eastern Canada. Canadian Naturalist, IV, No. 3, June, 1859, pp. 197-200; and No. 4, Aug., 1859, pp. 241-242.

Binney, W. G.

1861 Catalogue of Land and Freshwater Univalve Mollusks collected in British America by Messrs. Ross, Kennicott and Drexler, and deposited in the Smithsonian collection. Proc. Acad. Nat. Sciences, Philadelphia, for 1861, October, p. 330 (Extras p. 59).

1876 On the lingual dentition, jaw and genitalia of Carelia, Onchidella, and other Pulmonata. Proc. Acad. Nat. Sciences, Philadelphia, for 1876, pp. 183-192, pl. VI; also: Notes on Am. Land Shells, III, pt. I, 1876.

1885 Manual of American Land Shells. Bulletin U. S. National Museum, No. 28. Washington, 1885, pp. 18-27.

Boettger, Oscar.

1880 Schnecken der Hudson Bai. Nachrichtsbl. d. Deutschen Malak. Ges., XII, p. 32, 1880.

Carpenter, Philip P.

1857 Report on the present state of our knowledge with regard to the Mollusca of the West Coast of North America. Extract from the Report of the British Association for the Advancement of Science for 1856, London, Taylor and Francis, 1857, 8°, pp. 159-368, pls. VI-IX. Also printed separately with four preliminary leaves, London, 1857; *cf.* pp. 197-198.

1864 Supplementary Report on the present state of our knowledge with regard to the Mollusca of the West Coast of North America. London, Taylor and Francis, 1864. Extract from the Report of the British Association for the Advancement of Science for 1863, 8°, pp. 517-686; *cf.* pp. 604-607. Also issued separately, and reprinted by the Smithsonian Institution, in Smithsonian Miscellaneous Collections, No. 252, Dec., 1872, 8°, pp. 3-172.

Christy, Robert Miller.

1885 Notes on the Land and Fresh Water Mollusca of Manitoba. Journal of Conchology (Leeds), IV, July, 1885, pp. 339-349.

Cockerell, T. D. A.

1887 Letter to the editor. Conchologist's Exchange, II, p. 68, Nov., 1887.

Cockerell, T. D. A., continued.

1891 The Slugs of British Columbia. The Nautilus, v, No. 3, July, 1891, pp. 30–32.

Cooper, William.

1834 List of Shells collected by Mr. Schoolcraft in the Western and Northwestern Territory. Schoolcraft's Narrative of an Exp. to Itaska Lake, App., pp. 153–156, 1834.

Dall, W. H.

1885 Contributions to the Natural History of the Commander Islands, No. III. Report on the Mollusca of the Commander Islands, Bering Sea, collected by Leonhard Stejneger in 1882 and 1883. Proc. U. S. Nat. Museum for 1884, VII, pp. 340–349, 1885.

1885 New or specially interesting Shells of the Point Barrow Expedition. Proc. U. S. Nat. Museum for 1884, VII, pp. 523–526, 1885.

1885 Report of the International Polar Expedition to Point Barrow, Alaska. Washington, Government Printing Office, 1885, 4°. Natural History, part VI. Report on the Mollusks, pp. 177–184, with plate.

1886 Report on the Mollusks collected by L. M. Turner at Ungava Bay, North Labrador, and from the adjacent Arctic seas. Proc. U. S. Nat. Museum for 1886, IX, pp. 202–208.

1886 Contributions to the Natural History of the Commander Islands, No. VI. Report on Bering Island Mollusca collected by Mr. Nicholas Grebnitzki. Proc. U. S. Nat. Museum for 1886, IX, pp. 209–219.

1899 The Mollusk-Fauna of the Pribiloff Islands. Extract from The Furseals and Fur-seal Islands of the North Pacific Ocean. Washington, Government Printing Office, 1899. 4°, Part III, pp. 539–545, and map.

1905 On the relations of the Land and Freshwater Mollusk Fauna of Alaska and Eastern Siberia. Popular Science Monthly, vol. LXVI, No. 4, Feb., 1905, pp. 362–366.

Dawson, George Mercer.

1875 Land and Fresh Water Mollusca, collected during the summers of 1873–1874, in the vicinity of the Forty-ninth Parallel, Lake of the Woods to the Rocky Mountains. British North American Boundary Commission, Report on the Geology and Resources of the region in the vicinity of Forty-ninth Parallel (etc), 1875, App. E., pp. 347–350.

(**? Dawson, J. W.**)

1857 Description of some of the Fresh water Gastropods inhabiting the lakes and rivers of Canada. Canadian Naturalist, II, No. 3, 1857, pp. 195–215.

D'Urban, W. S. M.

1859-60 Observations on the Natural History of the valley of the Rivière Rouge and surrounding townships in the Counties of Argenteuil and Ottawa. Canadian Naturalist, IV, No. 4, Aug., 1859, pp. 252–256; V, No. 2, Apr., 1860, pp. 81–99.

Dybowski, W.

1901 Studien ueber die Mollusken des Amur-gebietes. Nachrichtsbl. d. Deutschen Malak. Ges., XXXIII, pp. 129–144, Oct. 1901.

Dybowski, W., continued.

1903 Zur Kenntnis der Ostsibirischen Landschnecken. Nachrichtsbl. d. Deutschen Malak. Ges., xxxv, pp. 7–10, Feb. 1903.

1903 Beitrag zur Kenntniss du Mollusken-Fauna Kamtschatka's. Annal. Mus. Zool. Imp. Acad. Sci. St. Petersburg, VIII, 1903, pp. 40–55, with 8 figures in the text.

Fabricius, Otho.

1780 Fauna Groenlandica. Lipsiæ, J. G. Rothe, 1780, 8°, pp. XVI, 452, 1 pl.

Fulton, Hugh.

1905 On New Species of Helicarion, Ariophanta, Eulota (etc). Ann. Mag. Nat. Hist., ser. VII, vol. XV, Jan., 1905, pp. 91–93.

Gebler, Friedrich August von.

1829 Sur le Musée de Barnaoul en Sibérie. Bull. Soc. Nat. de Moscow, I, pp. 51–59, 173–188, 1829.

Gerstfeldt, G.

1859 Ueber Land- und Süsswasser-Mollusken Siberiens und des Amur-gebietes. Mémoires des savants étrangers, IX, pp. 507–548, pl. IX, June, 1859. Imp. Acad. Sci. St. Petersburg.

Graeser, Louis, see Mousson, Albert.

Hanham, A. W.

1899 A list of the Land and Fresh Water Shells of Manitoba. The Nautilus, XIII, No. 1, May, 1899, pp. 1–6.

Heron, Gilbert Clifford.

1880 On the Land and Fresh-water Shells of the Ottawa. Transactions of the Ottawa Field Naturalist's Club, I, 1880, pp. 36–40, pl. II, figs. 3–8.

Krause, Aurel.

1883 Einige Landschnecken von der Tschuktschenhalbinsel und aus den Sudöstlichen Alaska. Sitzungs-bericht der Ges. Naturf. Freunde zu Berlin, 1883, No. 3, pp. 31–37.

Krynicki, Johann.

1837 Bull. Soc. des Nat. de Moscou, X, p. 57, 1837.

Latchford, F. R.

1882 Notes on the Ottawa Unionidæ. Transactions of the Ottawa Field Naturalist's Club, III, 1882, pp. 48–57, and plate.

1886 Observations of the Terrestrial Mollusca of Ottawa and Vicinity. Ottawa Field Naturalist's Club, II, No. 2, pp. 1–21, 1886.

1890 Report of the Conchological Branch. Ottawa Naturalist, 1890. Extra copies pp. 1–7.

1895 Casselman Shells. Ottawa Naturalist, IX, No. 7, Oct., 1895, p. 156.

1896 Notes on Recent Canadian Mollusca. Ottawa Naturalist, X, No. 1, April, 1896, pp. 14–16.

Latchford, F. R., and Fletcher, J.

1894 Report of the Conchological Branch. Ottawa Field Naturalist's Club, 1893. Ottawa Naturalist, VIII, No. 6, Sept., 1894, pp. 97–98.

Latchford, F. R., and Poirier, P.

1884 Report of the Conchological Branch (for 1883). Transactions of the Ottawa Field Naturalist's Club, II, No. 1, 1884, pp. 130–134.

Latchford, F. R., and Poirier, P., continued.

1884 Report of the Conchological Branch (for 1884). Transactions Ottawa Field Naturalist's Club, II, No. 2, 1884, pp. 263–266.

1887 Report of the Conchological Branch (for 1885). Transactions Ottawa Field Naturalist's Club, II, No. 3, 1887, pp. 350–351.

Lea, Isaac.

1861–62 Descriptions of two New Species of Anodonta from Arctic America. Proc. Acad. Nat. Sciences, Philadelphia, XIII, p. 56. March, 1861; also Journ. Acad. Nat. Sciences, Philadelphia, V, pp. 212–214, pls. XXXII, XXXIII, 1862.

1867–68 Descriptions of five New Species of Unionidæ and one Paludina of the United States. Proc. Acad. Nat. Sciences, Philadelphia, XIX, p. 81, 1867; also Journ. Acad. Nat. Sciences, VI, p. 287, pl. IX, 1868.

Lehnert, E.

1884 Alaska Plants and Shells. Science Record (Boston, Mass.), II, No. 8, pp. 171–172, June 16, 1884.

Lord, John Keast.

1866 The Naturalist in Vancouver Island and British Columbia. London, Richard Bentley, 1866, 2 v., 8°. *Cf.* Volume II, Appendix, pp. 356–370,

Maack, R.

1853 Notizen ueber einiger Land- und Süssw.-Mollusken, etc., mit Zusatz von Dr. A. Th. von Middendorff. Bull. Phys. Math. Akad. Imp. des Sci., St. Petersburg, XI, p. 372, 1853; Mélanges Biol., II, pp. 8–18, and 19–22, 1853.

Martens, Carl Eduard von.

1855 Ueber der Verbreitung der Europaeischen Land- und Süsswasser-Gasteropoden. Inaugural dissertation, Tübingen, 1855, pp. 144, 8°.

1872 Conchylien aus Alaschka. Malakozoologische Blätter, XIX, pp. 78–80. 1872.

1882 [Shells of the Krause Expedition.] Sitzungsbericht der Ges. Naturf Freunde zu Berlin, 1882, No. 9, pp. 138–143.

1885 Binnen Mollusken aus Mittel- und Ost-Asien. Conchol. Mittheil., II, heft V, pp. 179–185, 1885.

Mayer, Charles.

1869 [Mollusca of the Plant beds] Heer, Flora fossilis Alaskana; Kong. Svensk. Vetensk.-Akad. Handl., n. ser., VIII, pp. 40–41, pl. X, figs. 7–13, 1869.

Middendorff, A. Th. von.

1851 Sibirische Reise. Süsswasser und Land Mollusken, II, Th. 1, pp. 273–308, 389–433, 1851.

1851 Beschreibung einen neuen Molluskenarten, nebst einem Blicke auf den geographischen Charakter den Land- und Süsswasser-Mollusken Nord Asiens. Bull. Phys. Math. Akad. Imp. des Sci. St. Petersburg, IX, pp. 108–112, 1851. Mélanges Biol., I, pp. 160–164, 1851. See also Maack, R.

Möller, H. P. C.

1842 Index Molluscorum Groenlandiæ. Hafniæ, C. A. Reitzel, 1842, 8°, pp. 26.

Mörch, O. A. L.

1868 On the Land and Fresh Water Mollusca of Greenland. Amer. Jour. Conch., IV, pp. 25–40, pls. III, IV, 1868.

1857 Prodromus Fauna Molluscorum Grönlandiæ. Rink's Greenland, App., pp. 75–100, 1857. A second edition, revised and augmented, in the Arctic Manual, London, 1875, pp. 124–135.

1877 The Greenland Fauna, IV, Mollusca. Rink's Danish Greenland, London, 1877, Appendix, pp. 435–442.

Morelet, Arthur.

1858 Coquilles Terrestres du Kamtchatka. Journal de Conchyliologie, VII Juillet, 1858, pp. 7–9.

Mousson, Albert.

1887 Coquilles Terrestres et Fluviatiles recueillies par M. Louis Graeser dans le bassin de l'Amour (etc.). Journal de Conchyl., XXXV, pp. 10–32, Jan., 1887.

Note.—This paper was only discovered after the completion of the present memoir. Nearly all the species mentioned in it are from the upper waters of the Amur River, or from Vladivostok. *Succinea insularis* Mousson, from an island at the mouth of the Amur, is the only addition to the species properly belonging to the Primorski province, treated of in my discussion of the species of the Northeast coast of Siberia, but several are added to the list of Mongolian elements of the fauna of the Amur drainage.

Nylander, Olof O.

1899 A list of Shells from Northeastern Maine. The Nautilus, XIII, No. 8, Dec., 1899, pp. 102–106.

1901 Distribution of *Limnæa emarginata* Say, and the variety *Mighelsii* Binney, in Fish River, Aroostook Co., Maine. 8°, pp. 1–4, pl. I–IV, Caribou, Maine, the author, 1901.

Pilsbry, H. A.

1888 Lyogyrus, Gill, and other American Shells. Conchologist's Exchange, II, p. 113, 1888.

1898 Descriptions of new species and varieties of American Zonitidæ and Endodontidæ. The Nautilus, XII, No. 8, Dec., 1898, pp. 85–87.

1899 New and little known species of Pristiloma. Proc. Acad. Nat. Sciences, Philadelphia, for 1899, pp. 185–187, pl. IX.

1899 Remarks on the American species of Conulus. The Nautilus, XII, No. 10, Feb., 1899, pp. 113–117.

1899 Notes on a few Northwest American Land Snails. Proc. Acad. Nat. Sciences, Philadelphia, for 1899, pp. 314–315.

Poirier, Pascal.

1883 Report of the Conchological Branch (for 1882). Transactions Ottawa Field Naturalist's Club, I, No. 4, 1883, p. 74.

Posselt, Henrik J.

1898 Conspectus Fauna Grönlandicæ. Meddelelser om Grönland, XXIII, pp. XX, 298, 2 pl. and 1 map. 8°. Kjöbenhavn, Bianco Luno, 1898; *cf.* pp. 257–268.

Provancher, Léon.

1890 Les Mollusques de la Province de Quebec. Le Naturaliste Canadien, XXIII, No. 9, Mar., 1890, pp. 184–187, and No. 10, April, pp. 203–205.

Rackett, Thomas.

1822 Descriptions of some Shells found in Canada. Transactions Linnean Soc., XIII, pp. 42–43, 1822.

Randolph, P. B.

1899 Collecting Shells in the Klondike country. The Nautilus, XII, No. 10, Feb., 1899, pp. 109–112.

Reinhart, J.

1883 Die von den Herren Gebrüder Krause auf ihrer Reise gesammelten *Pupa-*, *Hyalina-*, und *Vallonia*-arten. Sitzungsbericht der Ges. Naturf. Freunde zu Berlin, 1883, No. 3, pp. 37–43.

Schrenck, Leopold von.

1867 Reisen und Forschungen im Amurlande in den jahren 1854–1856. II, (3): Mollusken des Amurlandes und des Nordjapanisches Meeres. St. Petersburg, K. Akad. der Wissenchaften, 1867, 4°, pp. 259–976.

Sheppard, Mrs., of Woodfield

1829 On the Recent Shells which characterize Quebec and its environs. Trans. Literary and Scientific Society of Quebec for 1829, I, pp. 188–198.

Shimek, B.

1893 List of the Shells collected on the Lower Saskatchewan in 1892 by C. C. Nutting. Bulletin University of Iowa, Nat Hist., II, 1893, pp. 291–292. *Cf.* also Ottawa Naturalist, X, p. 15, 1896.

Siemaschko, Julian Marc von.

1849 Bemerkungen ueber einige Land- und Süsswasser-Mollusken Russlands. Bull. Phys. Math. Akad. Imp. des Sci. de St. Pétersbourg, VII, 1848, pp. 225–240, 1849.

Small, H. B., and Symes P. B.

1882 Report of the Conchological Branch (for 1881). Transactions Ottawa Field Naturalist's Club, I, No. 3, 1882, pp. 57–59.

Sowerby, James de Carle.

1836 Mollusca. Richardson, Fauna Boreali-Americana, III, p. 315, London, 1836.

Taylor, George W.

1889 The Land Shells of Vancouver Island. Ottawa Naturalist, III, No. 3, pp. 84–94, 1889.

1891 Land Shells of Vancouver Island. The Nautilus, V, No. 8, Dec., 1891, pp. 91–92.

1893 Land and Freshwater Shells in the Rocky Mountains. The Nautilus, VII, No. 8, Dec., 1893, p. 85.

1895 The Land and Freshwater Shells of Alberta. Ottawa Naturalist, IX, No. 9, Dec., 1895, pp. 173–178.

1897 Planorbis nautileus in America. The Nautilus, X, No. 12, pp. 139–140, April, 1897.

Taylor, John W.

1885 Description of a New Species of Planorbis from Manitoba. Journal of Conchology, IV (Leeds), 1885, p. 351.

Tryon, George W.

1865 Descriptions of New Species of North American Limnæidæ. Amer. Journ. Conch., I, p. 231, 1865.

Vanatta, E. G.

1896 The Geographic Distribution of Planorbis umbilicatellus. The Nautilus, IX, No. 10, Feb., 1896, p. 117.

Westerlund, Carl Agardh.

1883 Von der Vega Exp. in Asien gesammelten Binnen Mollusken. Nachrichtsbl. d. Deutschen Malak. Ges., XV, pp. 48–59, April, 1883.

1885 Land och Sötvatter Mollusker, insamlade under Vega-expeditionen. Vega Exped. Vetenskapliga Iakttagelser, IV, pp. 141–220, 1885.

Whiteaves, J. F.

1863 On the Land and Freshwater Mollusca of Lower Canada. Canadian Naturalist, Feb., 1863, pp. 50–65. April, pp. 98–107. Extra copies pp. 1–31, 1863.

1880 List of Freshwater Mollusca from Manitoba and the valley of the Nelson River. Geological Survey of Canada, Report of Progress for 1878–79, Montreal, 1880. Report of Explorations of the Churchill and Nelson Rivers, by Robert Bell. Appendix, III, pp. 61–62, C.

1881 Mollusca. Geological Survey of Canada. Report of Progress for 1879–80, Montreal, 1881. Report on Hudson's Bay, by Robert Bell. Appendix, IV, pp. 75–76, C.

1887 On some Marine Invertebrata dredged, or otherwise collected, by Dr. G. M. Dawson, in 1885, on the coast of British Columbia, with a supplementary list of a few Land and Fresh Water Shells (etc.) from the same region. Transactions Royal Society of Canada for 1886, IV, section IV, 1887, pp. 111–137, with 4 text-figures.

1895 Notes on Recent Canadian Unionidæ. Canadian Record of Science, VI, No. 5, Jan., 1895, pp. 250–263.

1895 Additional notes on Recent Canadian Unionidæ. Canadian Record of Science, VI, No. 5, Jan., 1895, pp. 365–366.

1895 Recent Mollusca from the headwaters of the Ottawa. Ottawa Naturalist, IX, April, 1895, p. 22.

1901 Notes on some Land and Freshwater Mollusca from Fort Chimo, Ungava Bay, Ungava. Ottawa Naturalist, XIV, No. 12, Mar., 1901, pp. 221–223.

1902 Notes on some Fresh Water and Land Shells from Keewatin, Northern Ontario and British Columbia. Ottawa Naturalist, XVI, 1902, pp. 91–92.

1905 Notes on some Freshwater Shells from the Yukon Territory. Nautilus, XIX, No. 1, pp. 1–3, May, 1905.

1905 Lists of a few species of Land and Freshwater Shells from the immediate vicinity of James Bay, Hudson Bay. Nautilus, XIX, No. 1, p. 4, May, 1905.

PLATE I.

(The figures are natural size.)

FIG. 1. *Lymnæa preblei* Dall. The reflected margin of the aperture below the umbilicus is somewhat broken. See p. 70.

2. A younger specimen of the same species from behind.
3. *Lymnæa randolphi* F. C. Baker; p. 71.
4. The same species, another specimen, from behind; p. 71.

FRESHWATER SHELLS OF ALASKA

HELIOTYPE CO., BOSTON.

PLATE II.

(The specimens are figured natural size except when otherwise stated.)

FIGS. 1, 2. *Valvata helicoidea* Dall, magnified four diameters. The umbilicus is partly hidden by a calcareous deposit; p. 123.

3. *Lymnæa petersi* Dall; p. 66.

4, 5. *Lymnæa anticostiana* Dall; p. 79.

6. *Lymnæa ? perpolita* Dall; p. 78.

7, 9. *Lymnæa atkaënsis* Dall; p. 66.

8. *Lymnæa ? perpolita* Dall, magnified two diameters; p. 78.

10, 11. *Planorbula christyi* Dall, magnified two diameters; p. 99.

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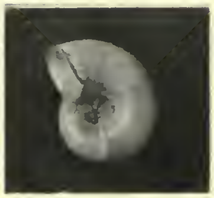

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FRESHWATER SHELLS OF ALASKA

HELIOTYPE CO., BOSTON.

INDEX TO GENERA AND SPECIES

New genera and species and the pages on which they are described are in **black-face type**; synonyms in parenthesis; pages where synonymy of known species or genera is given in *italics;* varietal names are treated as specific for the purposes of the Index.

HYDROIDS OF THE EXPEDITION

The following paper on the Hydroids of the Expedition, by Professor C. C. Nutting, of the University of Iowa, was originally published in the Proceedings of the Washington Academy of Sciences, vol. III, pp. 157–216, May 11, 1901. It is here reprinted from the same electrotype plates, so that it may be quoted exactly as if it were the original. The original pagination has been preserved and transferred to the inner or hinge side of the page, where it is enclosed in brackets, thus [159]; while the consecutive pagination of the present volume has been added in the usual place. In the plates the original number and running headline, slightly abbreviated, have been preserved [in brackets], while the volume designation and serial plate number have been added in the usual place. The original text references to the plates are unchanged. The present headpiece and title have been substituted for the running heading of the Academy's Proceedings and the original title, which was: *Papers from the Harriman Alaska Expedition. XXI. The Hydroids.* No other alterations have been made.

EDITOR.

HYDROIDS OF THE EXPEDITION

BY C. C. NUTTING

CONTENTS

INTRODUCTION.

The collection of Hydroida secured by the Harriman Expedition is of exceptional interest, and proves to be one of the most important and most extensive collections of these beautiful forms of marine life thus far made in Alaskan waters. Our previous knowledge of the Hydroid fauna of this region rested almost exclusively on the collection made by Dr. W. H. Dall and his associates during the years 1871–1874 and reported on by Dr. S. F. Clark.[1] The number of species listed in Clark's report is 41, in which was included *Coppinia arcta*, now known to be merely the gonosome of *Lafœa*. Of these 40 species, 15 are well known British forms, and only one was then known from the Atlantic coast of the United States. The remaining 24 species were new.

[1] Report on the Hydroids collected on the coast of Alaska and the Aleutian Islands by W. H. Dall, U. S. Coast Survey, and party, from 1871 to 1874, inclusive. Proc. Acad. Nat. Sciences, Philadelphia, 1876.

In 1878 C. Mereschkowsky[1] added a single species to the Alaskan fauna, bringing the total up to 41.

No other additions were made until 1899, when I added eight, of which three were well known British species and five were new.[2] That made a total of 49 species reported prior to the Harriman Expedition.

The collection here treated of comprises 53 species, 24 of which had been previously reported. Of the remainder, 9 were previously recorded from other localities, and 20 are new. Thus the Harriman Expedition has added about 60 percent to the number of species hitherto known from Alaskan waters. More than half of the species secured are new to Alaska and nearly 40 percent are new to science.

The whole number of species of hydroids now known from Alaska is 78. Considering the small amount of collecting that has been done in that region, compared with the extensive explorations of the coasts of Europe and the Atlantic coast of the United States, one may confidently expect that the waters of the far Northwest will prove to be very rich in hydroid life.

GEOGRAPHIC DISTRIBUTION.

A table is here given to indicate, first, the localities at which each species was collected by the Harriman Expedition, and second, the extent to which Hydroids have been distributed southward along meridional lines from what appears to have been a polar center of distribution. No attempt has been made to represent the complete distribution of the species.

A glance at the part of the table showing the distribution as represented in the collection secured by the expedition, shows an apparent poverty of the Hydroid fauna of the western, as compared with the eastern, portion of the territory explored. For convenience in such comparison the stations are arranged consecutively from east to west. The largest series were obtained at Berg Inlet in Glacier Bay; Yakutat Bay; and at Orca in Prince William Sound. These localities are all in deep bays, sheltered from storms and surrounded by rocky shores. On

[1] New Hydroida from Ochotsk, Kamtschatka, and other parts of the North Pacific Ocean. Annals and Mag. Nat. Hist., Dec., 1878.

[2] Hydroida from Alaska and Puget Sound. Proc. U. S. Nat. Museum, Vol. XXI. (No. 1171.)

GEOGRAPHIC DISTRIBUTION OF THE HYDROIDS COLLECTED BY THE HARRIMAN EXPEDITION.

Name.[1]	Distribution of Specimens in the Harriman Collection.									General Distribution.				
	Juneau.	Sitka.	Berg Inlet.	Yakutat.	Orca.	Kadiak.	Popof Island.	Unalaska.	Dutch Harbor.	Europe.	Arctic Regions.	East Coast U. S.	Pacific Coast South of Alaska.	Alaska only.
Syncoryne eximia.	+									+	+			
*Coryne brachiata.				+										+
*Garveia annulata.	+			+										+
Garveia nutans.			+							+				
Eudendrium vaginatum.	+	+		+						+				
*Tubularia harrimani.					+									+
*Campanularia ritteri.	+													+
Campanularia denticulata.					+									+
Campanularia verticillata.						+				+	+	+	+	
Campanularia lineata.			+										+	
Campanularia speciosa.					+						+			
Campanularia urceolata.				+										+
*Campanularia reduplicata.				+										+
*Campanularia regia.					+									+
Clytia caliculata.				+						+	+	+	+	
Clytia compressa.					+									+
Obelia plicata.					+					+			+	
Obelia dichotoma.		+	+		+					+	+	+	+	
*Obelia borealis.				+										+
*Obelia dubia.					+									+
Hebella pocillum.						+				+	+	+	+	
*Gonothyræa inornata.				+										+
*Campanulina rugosa.	+													+
Calycella syringa.			+			+				+	+	+	+	
Lafœa dumosa.									+	+	+	+	+	
Lafœa gracillima.	+		+							+	+	+	+	
Lafœa fruticosa.	+		+			+				+	+	+	+	
*Lafœa adhærens.						+								+
*Grammaria immersa.						+								+
Filellum serpens.	+									+	+	+		
Halecium halecinum.						+				+	+	+	+	
Halecium muricatum.					+					+	+	+		
Halecium scutum.			+	+						+				
*Halecium reversum.	+													+
*Halecium robustum.			+											+
*Halecium ornatum.			+											+
*Halecium speciosum.				+										+
Sertularella tricuspidata.	+		+	+					+	+	+	+	+	
Sertularella polyzonias.					+					+	+	+	+	
*Sertularella saccata.							+				+			
Thuiaria argentea.				+						+	+	+	+	
Thuiaria similis.			+										+	
Thuiaria variabilis.					+								+	
Thuiaria cupressoides.				+										+
*Thuiaria coei.									+					+
Thuiaria fabricii.					+						+		+	
Thuiaria turgida.		+			+		+		+					+
Thuiaria gigantea.						+	+							+
Thuiaria thuiarioides.				+									+	
*Thuiaria elegans.			+											+
*Thuiaria costata.				+										+
Plumularia lagenifera.		+						+					+	
Plumularia palmeri.													+	
Totals.	10	4	12	15	13	8	3	1	4	19	18	14	20	25

[1] Species marked by a * are new.

account of the presence of perpetual ice in the form of glacier fronts and bergs, the water must be very cold the year around. Such a combination of conditions is particularly favorable to Hydroid life and accounts for the remarkably rich collections made at these places and also for the presence of so many arctic species. In this connection it is interesting to note the following paragraph written about twenty five years ago by Dr. Dall: "The material derived from the northwestern coasts of America, from Cook's Inlet south and east, indicates a series of Arctic colonies in favored localities, the future exploration of which offers a labor of the highest interest. These colonies are situated where the depth of water, the drippings of glaciers, and the high and adjacent shores of the Great Archipelago combine to reduce the temperature of the water below its apparently normal isotherm. Cook's Inlet affords one of them, one exists in the Gulf of Georgia, and others only await further exploration."[1] It should be noted, however, that nearly all of the Arctic species are well known forms belonging to the 'Holarctic Province' of authors, and that these species are of practically continuous distribution on all coasts in northern regions so far as explored.

In the same paper, Dr. Dall divides the coasts of America from Monterey, California, north and west, into three faunal areas, as follows: (*a*) the *Oregonian*, extending from Monterey to the Shumagin Islands; (*b*) the *Aleutian*, extending from the Shumagin Islands to the end of the Aleutian chain, and northward to the winter line of floating ice in Bering Sea; (*c*) the *Arctic*, limited on the shore line to the winter line of floating ice and passing southward indefinitely in deep water.

This paper deals chiefly with what Dr. Dall would call the Oregonian Fauna, only seven species having been secured to the westward of the Shumagin Islands. Of these seven species five are also found in his Oregonian Fauna, and the other two are new and known, thus far, from only one locality.

Dr. Clark, in reporting on the collection made by Dr. Dall, enumerates 25 species that occur west and north of the Shumagin Islands. Of these 25 species we now know that sixteen

[1] Proc. Acad. Nat. Sciences, Philadelphia, p. 206, 1876.

also occur to the eastward of the Islands, while five have not been reported from any locality other than the ones where they were originally discovered. Our present knowledge therefore does not support the validity of Dr. Dall's division of faunæ at the Shumagin Islands. It rather indicates a continuity of fauna from southern Alaska to the end of the Aleutian chain. Hydroid life appears to decrease as we go westward, but this may be only apparent and due to the more extensive exploration of the shores east of the Aleutian Islands.

Dr. Dall extends his *Oregonian* fauna down to Monterey, California. Reasoning again merely from the known distribution of hydroids, it would seem that Puget Sound is a natural region of demarcation between faunæ, although the region from Puget Sound to San Francisco has been very little explored. In 1876 Dr. Clark published a paper on 'The Hydroids of the Pacific Coast of the United States south of Vancouver Island,'[1] in which he gives a list of twenty-four species; of these only two, *Lafœa dumosa* and *Sertularia argentea*, have as yet been reported north of Puget Sound. The same author, in reporting on Dr. Dall's collections from Alaska, notes as one of the main points of interest, the "small number of species that are common to the Alaskan coast and the western shores of the United States from Vancouver Island southward.[2] In 1899 the present writer published a paper on 'Hydroida from Alaska and Puget Sound'[3] in which it appears that out of twenty-two species from Puget Sound, only four have been reported farther south, while fifteen are now known to occur in Alaska. In the same year Mr. G. N. Calkins published a paper entitled 'Some Hydroids from Puget Sound,'[2] in which some thirty species are noted, only two of which are known to occur south of Puget Sound.

From this study of the distribution of the Hydroids of the northwest coast of America, therefore, I am strongly persuaded that the region *south* of Puget Sound constitutes one distinct faunal area, and that the region from Puget Sound north and west to the end of the Aleutian chain constitutes another un-

[1] Trans. Conn. Acad. Sci., Vol. III, pp. 250–251, 1876.
[2] Proc. Acad. Nat. Sciences, Philadelphia, p. 212, 1876.
[3] Proc. U. S. Nat. Museum, Vol. XXI, No. 1171, 1899.
[4] Proc. Bost. Soc. Nat. Hist., Vol. XXVIII, No. 13, 1899.

broken faunal area that might properly be designated as *Alaskan*. From the number of arctic species included in this area it is not improbable that it extends northward along the shores of Bering Sea.

Dr. Clark agrees with Dr. Dall that there is a distinct faunal difference between the region east of the Shumagin Islands and that west of them. The material added since the publication of his paper, however, seems to prove that this difference is only apparent and due solely to lack of exploration.

The most important thing to be noted in that part of the table devoted to general distribution is the Holarctic distribution of a number of species. Of the eighteen species known to occur in the Arctic region, no less than fifteen also occur on the European coast, fourteen on the Atlantic coast of the United States, and thirteen on the Pacific coast as far south as Puget Sound. An examination of the table shows further, that the Hydroid fauna of Alaska, as represented by the Harriman collection, includes fifty-three species in all, of which eighteen are Arctic in fact, having been secured in Arctic waters; four others are in all probability Arctic, being found both in European and American waters; four are, so far as is known, confined to the Alaskan and Pacific coast south to Puget Sound; twenty-five are thus far known from Alaska only, and two are Californian. If we recognize the Alaskan faunal region as extending to Puget Sound, and include those species actually known to be Arctic, together with those in all probability Arctic, in a group which may justly be called Arctic, the following significant analysis of the faunal relations of the collection may be made: Alaskan species, twenty-nine; Arctic species, twenty-two; Californian species, two. This shows that fifty-five percent of the hydroid fauna as a whole is peculiar to Alaska, but that there has been a strong invasion from the Arctic regions of the Holarctic species constituting about forty-one percent of the collection, and that only two species, or less than four percent, are Californian. If all the species known to occur in Alaska were included in the computation the result would be a larger percentage of Alaskan species, a corresponding decrease of the Arctic species, and the addition of one or two Californian species.

SYSTEMATIC DISCUSSION.

The writer deems it unnecessary to attempt a complete synonymy of the well known European species contained in the Harriman collection and considers it sufficient to give, *first*, and in all cases, the original reference to the species; *second*, all obtainable references to the occurrence of the species on the Pacific Coast of America, and, *third*, a reference to verify the 'General Distribution' as given in the table just discussed. In this latter case only one reference will be given to verify the occurrence of a given species in each of the regions included in the right hand portion of the table.

As to the classification employed in this report, it seems best, on the whole, to pursue a conservative course, following pretty closely the lines laid down by the able British naturalists, Hincks and Allman. While it is true that the classification is in an unsatisfactory state, the writer does not feel that a thorough revision of the entire group of Hydroida should be attempted here, and frankly confesses his conviction that recent attempts in that direction have not been successful, though each contains valuable suggestions. Levinsen, for example, has made a notable contribution to our knowledge of the Campanulinidæ in his able and careful exposition of the differences in the opercula of various species, but his genera founded solely on these structures appear to be artificial, as usually happens when a single character is made the basis of classification.[1] In his terse characterization of the genera of Sertularidæ this author has been most fortunate, as well as in his masterly clearing up of the mystery concerning the gonosome of *Lafœa*.

Schneider,[2] also, has attempted to rearrange the Hydroida on a logical basis. Instead of multiplying groups, as has been the tendency of late, he has, in my opinion, gone far to the other extreme, uniting families that almost any other student acquainted with the group would regard as surely distinct. It seems unlikely that he will be followed in uniting such groups as the Tubularidæ and Pennaridæ in a single family, although one

[1] Meduser, Ctenopherer og Hydroider fra Grönlands Vestkyst, Copenhagen, 1893.

[2] Hydropolypen von Rovigno, nebst übersicht über das system der hydropolypen in allgemeinen. Zool. Jahrb., Syst. Abth., Vol. x, 1897.

writer, Calkins,[1] has followed his classification quite closely, and includes representatives of what would ordinarily be regarded as at least eleven families in five families as defined by Schneider.

It is not likely that classifications will ever represent anything but individual opinion, and it is probable that there will always be two sets of extremists who on the one hand will be too ready to multiply groups, and on the other will be too conservative to recognize real progress. The Hydroida offer unusual difficulties and consequently students of that group find agreement, even along the most general lines, practically impossible. The objective point of systematic discussion has been the attainment of a system of classification by which genera could be distinguished by means of the trophosome alone. This end, although in theory greatly to be desired, appears to be unattainable. The writer has chased this will-o-the-wisp for years, and is ready to abandon its pursuit as unprofitable. Abler men have had the same experience, and it appears to be pretty well established that in practice we must base generic distinctions on the gonosome alone, although the judgment of students will inevitably differ as to the extent to which this can be profitably done. Botanists have encountered the same difficulty in their study of the lower plants, such as the fungi, and have come to the same conclusion. In neither case has nature been working for the convenience of naturalists, and the fact should be accepted without a bootless chase after the unattainable.

GYMNOBLASTEA.

Hydroida in which well differentiated hydrothecæ and gonangia are not present. What might be called 'pseudo-hydrothecæ' are found in some species as in *Eudendrium vaginatum* (see description of that species on pages 167–168).

Family *CORYNIDÆ.*

Trophosome.—Hydranth with a terete body and proboscis and scattered capitate tentacles only.

Gonosome.—Fixed sporosacs, or free medusæ with a very long manubrium, four marginal tentacles and four sense-bulbs with eye-spots.

[1] Some Hydroids from Puget Sound, Proc. Bost. Soc. Nat. Hist., Vol. XXVIII, No. 13, 1899.

CORYNE.

Trophosome.—Characters of the family.

Gonosome.—Reproductive elements produced in fixed sporosacs growing on the hydranth body.

CORYNE BRACHIATA sp. nov.

(Plate XIV, figs. 1, 2.)

Trophosome.—Colony forming a dense tuft of irregularly branching stems, sometimes attaining a height of about ¾ inch. Stems and branches profusely and regularly annulated throughout, fairly stout except at the proximal ends where they taper gradually to their point of origin; distal ends of many of the branches bear a more or less regular whorl, or radiating cluster, of annulated branchlets just below the hydranth body, reminding one of the whorls of cirri around the stems of the stalked crinoids. Hydranths large, with long, slender body and proboscis and numerous (20–35) capitate tentacles arranged in a scattered or sub-verticillate manner over nearly the whole surface.

Gonosome.—Gonophores very numerous, borne among the tentacles on the hydranth bodies, globular in outline and showing no traces of radial canals or other medusoid structures. The specimens secured were females and the gonophores were packed full of developing ova.

Distribution.—All the specimens were secured in Yakutat Bay, Alaska, by Dr. W. R. Coe of the Harriman Expedition.

This interesting species seems to be nearest to *C. pusilla* Gaertner, if Allman has properly identified that species. It differs from other members of the genus in the curious whorl of short branchlets which bear neither hydranths nor gonophores and are situated a short distance below the terminal hydranth of the stem or branch to which they are attached. Another character not shown in the figures of this genus published by Hincks and Allman, is the narrowing at the proximal ends of the stems and branches. The specimens were found immersed in sponge so far that only the hydranths extended above the surface of the sponge.

SYNCORYNE.

Trophosome.—Characters the same as those given for the family.

Gonosome.—Reproductive elements produced in free medusæ with a long manubrium and four marginal tentacles, each having a sense bulb with an eye-spot at its base.

SYNCORYNE EXIMIA Allman.

(Plate XIV, figs. 3, 4.)

Coryne eximia ALLMAN, Annals and Mag. Nat. Hist., 3d Series, Vol. IV, p. 141. Aug., 1859.
Syncoryne eximia ALLMAN, Annals and Mag. Nat. Hist., 3d Series, Vol. XIII, p. 357. May, 1864.

This appears to be the first record of the occurrence of this species in American waters. There are many specimens in the collection, but all are from the same locality.

Distribution.—Juneau, Alaska (Harriman Expedition); Great Britain (Allman and Hincks); Lofoten Islands, Norway (Sars).

Family *BIMERIDÆ.*

Trophosome.—Hydranths with a conical or dome-shaped proboscis, around the base of which is a whorl of filiform tentacles.

Gonosome.—Sexual products developed in fixed sporosacs.

GARVEIA.

Trophosome.—Colony branched; perisarc conspicuous.

Gonosome.—Gonophores borne on distinct branchlets which have a chitinous investment ending in a cup-like expansion just below the gonophore.

GARVEIA NUTANS Wright.

Garveia nutans WRIGHT, Edinburgh New Phil. Jour., p. 109. July, 1859.
Eudendrium bacciferum ALLMAN, Annals and Mag. Nat. Hist., 3d Series, Vol. IV, p. 52, July, 1859.

This is another species that has not before been reported from American waters. The specimens were fragmentary, making the identification somewhat uncertain, although I have little doubt of its correctness.

Distribution.—Berg Inlet, Glacier Bay, Alaska. (Harriman Expedition.) Originally described from the British Coast.

GARVEIA ANNULATA sp. nov.

(Plate XV, figs. 1, 2.)

Trophosome.—Colony attaining a height of 1½ inches, consisting of a number of closely aggregated and sparingly and irregularly branched stems. Stems strongly and evenly annulated throughout, the perisarc expanding distally into thin chitinous pseudo-hydrothecæ which cover the hydranth body nearly to the level of the tentacles. Hydranths with

a conical, or rather conoid, proboscis and about sixteen tentacles all of which appear to be held more or less erect.

Gonosome.—Gonophores borne either on the stem or hydrorhiza, more frequently the latter, oval in shape, borne on pedicels enveloped in a chitinous perisarc which ends in a slightly expanded collar a little below the gonophore. The specimens collected were female and the gonophores were packed with apparently mature ova.

Color.—The label accompanying the specimens bore the following statement: "Bright orange throughout, heads, stems and all."

Distribution.—Yakutat and Sitka, Alaska. Collected by the Harriman Expedition in considerable quantities.

This species can be sharply distinguished from its British relative by the very distinct and beautiful annulation which covers the entire stem and branches. It is much less extensively branched than the British species, and the gonophores are more generally borne on the roots.

The structure that I have designated above as a 'pseudo-hydrotheca' is of considerable morphological interest, for it may throw light on the origin of the hydrotheca. The extension of the chitinous perisarc of the stem over the body of the hydranth appears to be attached to the latter. A true hydrotheca would be formed if the perisarc around the hydranth body should become thicker and detached.

Family *EUDENDRIDÆ*.

Trophosome.—Colony branching. Hydranths with a single whorl of filiform tentacles and a trumpet-shaped or hemispherical proboscis which is expanded distally and contracted proximally, thus being sharply distinguished from the hydranth body.

Gonosome.—Reproductive elements developed in fixed sporosacs attached to a usually more or less degenerated hydranth body below the tentacles.

This family contains but one genus, *Eudendrium*, which needs no further definition.

EUDENDRIUM VAGINATUM Allman.

(Plate IV ~~xv~~, figs. 3–6.)

Eudendrium vaginatum ALLMAN, Annals and Mag. Nat. Hist., Third Series, Vol. XI, p. 10, Jan., 1863.

As the gonosome of this species has not heretofore been described, the following is inserted here:

Gonosome.—Gonophores (female) in dense clusters around the bodies of hydranths that are usually devoid of tentacles. Each gono-

phore is borne on a pedicel which resembles those of *Garveia*, having a distinct expanded collar a short distance below the hydranth.

Distribution.—Sitka Harbor and Yakutat, Alaska, abundant (Harriman Expedition); Shetland Island, Scotland (Allman).

This beautiful species bears considerable resemblance to *Eudendrium annulatum* Allman, especially in its gonosome which Allman describes as follows: "The gonophores are grouped in clusters, consisting of from eight to twenty egg-shaped bodies attached around the axis of gonoblastidea, which are of moderate length."[1]

Were it not for a peculiar character of the trophosome, *i. e.*, the expanded pseudo-hydrotheca investing the body below the tentacles much as in *Garveia*, there might be some suspicion that *E. vaginatum* and *E. annulatum* are synonyms, particularly in view of the fact that both were described from the Shetland Islands.

It also seems not improbable that *Eudendrium pygmæum* Clark[2] may be another synonym of *E. vaginatum*, as Clark's description of the gonosome agrees well with the gonosome described above. If this be true, it is also likely that the dried stems described by Clark from Santa Cruz, California, will be found to belong to this same species.

Family *TUBULARIDÆ.*

Trophosome.—Hydranths large, with a basal whorl of filiform tentacles and a distal set of closely crowded shorter filiform tentacles.

Gonosome.—Reproductive elements developed in sessile medusæ borne in clusters just above the basal tentacles and producing actinules instead of planulæ.

TUBULARIA.

The only genus included in the family in the sense here used.

TUBULARIA HARRIMANI sp. nov.

(Plate ~~XVI~~ V.)

Trophosome.—Stem usually unbranched, attaining a height of 1½ inches, irregularly and sparingly annulated and increasing in size from the proximal to the distal end, but more rapidly on the basal portion; a marked constriction some distance below the hydranth body; stem canaliculated between the constriction and the hydranth. Hydranth with forty to fifty basal tentacles and about twenty in the distal set.

Gonosome.—Gonophores borne in about twelve very long and densely crowded racemes, which are supported by long, tentacle-like

[1] Ann. and Mag. Nat. Hist., 3d Series, Vol. XIII, p. 83, Jan.. 1864.

[2] Proc. Acad. Nat. Sciences, Philadelphia, p. 232, 1876.

pedicels arising above the proximal row of tentacles. Gonophores (female) with three to five long tentacular processes which are sometimes half the length of the gonophore. The actinule at birth is without a distal row of tentacles, and the gonophore has no indication of radial canals.

Distribution.—Orca, Prince William Sound, Alaska (W. E. Ritter).

Exclusive of this species there have now been described four species of *Tubularia* from the Pacific Coast of North America; *Parypha microcephala* (A. Agassiz),[1] which differs from the present species in having flattened, instead of round, tentacular processes to the gonophores; *Tubularia elegans* Clark,[2] which has mere tubercles instead of the filiform processes to the gonophores; *Tubularia borealis* Clark,[3] which differs in having laterally compressed processes to the gonophores; and *Tubularia larynx* Ellis and Solander[4] (reported by Gary S. Calkins), which differs from *T. harrimani* in the number of both proximal and distal sets of tentacles, as well as in several other characters.

The species seems to be abundant at Orca, as numerous specimens were found.

CALYPTEROBLASTEA.

Hydroida in which hydrothecæ are developed for the protection of the hydranths and gonangia for the protection of the gonophores.

Family *CAMPANULARIDÆ.*

Trophosome.—Hydrothecæ well developed, non-operculate, never adnate nor immersed in the stem and always with a septum partially dividing the hydrothecal cavity from the stem cavity. Hydranths usually with conical proboscis and a single whorl of filiform tentacles.

Gonosome.—Gonophores producing planulæ or free medusæ.

It would be hard to find two authorities who would agree as to the genera of this exceedingly perplexing family. The arrangement here adopted is substantially the same as that used by the writer in another work now in press.[5] It is not offered as a final solution of the difficulty, but as a convenience in discussing the group in the present connection.

[1] North American Acalephæ, p. 195.

[2] Transactions Conn. Acad. Sci., Vol. III, p. 253, 1876.

[3] Proc. Acad. Nat. Sci. Philadelphia, p. 231, 1876.

[4] Proc. Boston Soc. Nat. Hist., Vol. XXVIII, No. 13, p. 335.

[5] Handbook of the Hydroids of the Woods Hole Region. To be published by the U. S. Fish Commission.

CLYTIA.

Trophosome.—Stem not regularly branched. Hydrothecæ with toothed margins, or with excessively thick walls and with long pedicels.

Gonosome.—Reproduction by means of free medusæ.

CLYTIA CALICULATA (Hincks).

(Plate ~~XVII~~ XI, figs. 1, 2.)

Campanularia caliculata HINCKS, Annals and Mag. Nat. Hist., 2nd ser., Vol. XI, p. 178, March, 1853.—VERRILL, Preliminary check-list of Marine Invertebrates of Atlantic Coast, etc., p. 16, 1879.—MARKTANNER-TURNERETSCHER, Hydroiden von Ost-Spitzbergen, Zool. Jahrb., Vol. VIII, p. 406. 1895.—CALKINS, Some Hydroids from Puget Sound, Proc. Boston Soc. Nat. Hist., Vol. XXVIII, No. 13, p. 351, 1899.

Some authors, as Levinsen, regard this species as identical with *C. integra* Macgillivray. The mode of reproduction is so different, however, that the two would go into different genera in the classification here adopted.

Distribution.—Yakutat, Alaska (Harriman Exped.); British Coast (Hincks); Spitzbergen (Marktanner-Turneretscher); New England Coast (Verrill); Puget Sound (Calkins).

CLYTIA COMPRESSA (Clark).

(Plate ~~XVII~~ XI, figs. 3, 4.)

Campanularia compressa CLARK, Proc. Acad. Nat. Sciences, Philadelphia, p. 214, 1876.

Eucopella campanularia (VON LENDENFELD)? Uber Coelenteraten der Sudsee, IV, Mitth. Zeitsch. Wiss. Zool., XXXVIII, p. 497, 1883.

Distribution.—Orca, Alaska (Harriman Exped.); Shumagin Islands (Clark). The figures given of this species well illustrate the great variation in thickness of the hydrothecal walls. All the specimens thus far discovered were found attached to Laminaria, over which they creep in great profusion.

Von Lendenfeld makes his *Eucopella campanularia* the subject of one of his masterly monographic papers and it appears to agree in every particular with the species under discussion. If I am correct in supposing the two species identical, the name *Eucopella companularia* will become a synonym and a very exceptional distribution will be recorded for *Clytia compressa*. It is interesting to note that von Lendenfeld's species was also found growing on Laminaria.

The present writer does not agree with Calkins in his suggestion that *C. compressa* is a synonym of *C. caliculata*.

CAMPANULARIA.

Trophosome.—Colony unbranched or regularly branched; stem simple or fascicled; hydrothecæ campanulate, never completely sessile nor with operculum.

Gonosome.—Gonophores producing planulæ without the intervention of medusæ.

CAMPANULARIA VERTICILLATA (Linn.)

Sertularia verticillata LINN., Syst. Nat., 10th ed., p. 811, 1758.
Campanularia verticillata SARS, Bidrag til Kundskaben om Norges Hydroider, p. 46, 1873.—VERRILL, Preliminary check-list of Marine Invertebrates of Atlantic Coast, p. 16, 1879.

Distribution.—Kadiak, Alaska (Harriman Exped.); North Cape, Norway (Sars); New England Coast (Verrill).

CAMPANULARIA DENTICULATA Clark.

Campanularia denticulata CLARK, Proc. Acad. Nat. Sciences, Philadelphia, p. 213, 1876.

Distribution.—Orca, Alaska (Harriman Exped.); Port Etches, Alaska (Clark).

CAMPANULARIA LINEATA Nutting.

Campanularia lineata NUTTING, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. XXI, p. 744, 1899.

Distribution.—Berg Inlet, Glacier Bay, Alaska (Harriman Exped.); Puget Sound (Nutting).

CAMPANULARIA RITTERI sp. nov.

(Plate ~~XVII~~ XI, fig. 5.)

Trophosome.—Colony usually consisting of unbranched pedicels growing directly from a creeping rootstock. Pedicels long and slender, usually with a single distinct annulation at the distal end just below the hydrotheca and about three less distinct ones at the proximal end, the middle portion not being annulated. Hydrothecæ cylindrical, large, delicate in structure and with a perfectly even rim.

Gonosome.—Unknown.

Distribution.—Juneau, Alaska, 20 fathoms. Collected by Prof. Wm. E. Ritter to whose efforts the fine series of Hydroids here discussed is so largely due, and for whom this species is named.

CAMPANULARIA SPECIOSA Clark.

(Plate ~~XVIII~~ VII, fig. 3, Plate ~~XIX~~ VIII, fig. 3.)

Campanularia speciosa CLARK, Proc. Acad. Nat. Sciences, Philadelphia, p. 214, 1876.—LEVINSEN, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, p. 25, 1893.

Campanularia crenata ALLMAN, Diagnoses of new Genera and Species of Hydroida, Linnæan Society Journal, Zoology, Vol. XI, p. 258, 1876.

Distribution.—Orca, Alaska (Harriman Exped.); Yukon Harbor, Big Koniuji, Shumagin Islands, Alaska (Clark); Japan Coast (Allman); Greenland (Levinsen).

CAMPANULARIA URCEOLATA Clark.

XII
(Plate ~~XVIII~~, fig. 2.)

Campanularia urceolata CLARK, Proc. Acad. Nat. Sciences, Philadelphia, p. 215, 1876.

Distribution.—Yakutat Bay, Alaska (Harriman Exped.); Lituya Bay, Alaska (Clark).

The specimens collected by the Harriman Expedition were growing profusely over the stems and branches of *Thuiaria costata* in company with another parasitic species.

CAMPANULARIA REDUPLICATA sp. nov.

XII
(Plate ~~XVIII~~, fig. 1.)

Trophosome.—Colony consisting of unbranched stems or pedicels springing from a creeping rootstock. Pedicels one to three times as long as the hydrothecæ, and strongly annulated throughout. Hydrothecæ deeply campanulate, thick-walled; margins armed with twelve to fourteen rather pointed teeth, and reduplicated once or twice, giving a striking and unusually ornate appearance.

Gonosome.—Gonangia roughly ovate, irregular in outline, with a short neck, small terminal aperture and a very short pedicel. They were empty in the specimens examined, so that it was impossible to ascertain whether they produced planulæ or medusæ.

Distribution.—Yakutat, Alaska (Harriman Exped.). All the specimens were found growing in a parasitic manner over colonies of *Thuiaria costata*, in company with *Campanularia urceolata.* The two species were often so intimately interwoven as they crept over the stems and branches of the sertularian that I, at first, thought them dimorphic forms of one species. However, in all cases careful dissection showed that they were entirely separate colonies. The reduplication of the hydrothecal margins seems to be a constant feature and adds peculiar beauty to this striking little campanularian.

CAMPANULARIA REGIA sp. nov.

VIII
(Plate ~~XIX~~, figs. 1, 2.)

Trophosome.—Colony consisting of a creeping rootstock without annulations, giving forth strong pedicels that are sometimes longer

than the hydrothecæ and sometimes considerably shorter, without a definite swelling below the hydrothecæ. Hydrothecæ immense, in one case nearly $\frac{3}{32}$ of an inch in height, long, tubular-urceolate, expanded distally, with slightly everted and broadly sinuous margin. The margin is reduplicated in one specimen. Hydranth with about twenty tentacles.

Gonosome.—Not known.

Distribution.—Orca, Prince William Sound, Alaska (W. R. Coe, Harriman Exped.).

This species is closely allied to *C. grandis* Allman,[1] and may be identical with it although it differs from Allman's description in the character of the pedicels which he describes as having distinct node-like enlargements immediately below the hydrothecæ. The hydrothecæ are larger than those of any other campanularian known to me. But one small colony was found and it was creeping over another hydroid.

OBELIA.

Trophosome.—Colony regularly branching; stem simple or compound. Hydrothecæ campanulate, thin, never with greatly thickened walls.

Gonosome.—Reproduction by means of medusæ which are disk-shaped, with four radial canals, more than eight marginal tentacles, eight interradial lithocysts and a short manubrium without mouth tentacles.

OBELIA DICHOTOMA (Linn.).

Sertularia dichotoma LINN., Systema Naturæ, Ed. x, p. 812. 1758.
Obelia dichotoma SCHULZE, Nordsee Expedition, Hydroida, p. 129, 1872.—VERRILL, Preliminary check-list Marine Invertebrates of Atlantic coast, p. 16, 1879.—CALKINS, Some Hydroids from Puget Sound, Proc. Boston Soc. Nat. Hist., Vol. XXVIII, No. 13, p. 256, 1899.

Distribution.—Sitka, Berg Inlet, and Orca, Alaska (Harriman Exped.); British Coast (Hincks); Helgoland (Schulze); Puget Sound (Calkins).

OBELIA PLICATA Hincks.

Obelia plicata HINCKS, British Hydroid Zoophytes, p. 159, 1868.—NUTTING, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. XXI, No. 13, p. 741, 1899.

Distribution.—Orca, Alaska (Harriman Exped.); Puget Sound (Nutting); British Coasts (Hincks).

[1] Diagnoses of new Genera and Species of Hydroida; Linnæan Soc. Jour. Zoology, Vol. XI, p. 259.

OBELIA BOREALIS sp. nov.

(Plate VIII ~~XIX,~~ figs. 4, 6.)

Trophosome.—Colony sometimes attaining a height of eighteen inches, but usually much shorter; stem not truly fascicled, although several stems may be interwoven, exceedingly long and slender, sinuous, giving off lateral branches in pairs on proximal portion and more often singly on distal portion; branches with a strong tendency to verticillate arrangement, forming oblique angles with the stem and divided into numerous branchlets in a flabellate manner. Pedicels short and completely annulated, or long and annulated only at ends, set on broad shoulders of the stem. Hydrothecæ funnel-shaped, the sides usually straight, aperture with an even rim. Hydranths not well preserved in specimens examined.

Gonosome.—Gonangia borne in axils of branches and branchlets, oblong-ovate, truncated above, having a collar in mature specimens; aperture apparently very large, pedicels strongly annulated. The gonangia of the specimens examined were filled with developing medusæ of the regular Obelia type.

Distribution.—Yakutat, Alaska (Harriman Exped.).

This fine species is related to *O. flabellata*, but the hydrothecæ are much deeper than in *O. flabellata*, in which they are sub-triangular in outline. It also bears some resemblance to *O. commissuralis*, which, however, is a much more delicate species, with smaller and more campanulate hydrothecæ.

OBELIA DUBIA sp. nov.

(Plate IX. ~~XX,~~ fig. 1.)

Trophosome.—Colony attaining a height of about ¾ inch; stem sparingly branched, the main stem and larger branches sinuous or slightly geniculate, giving forth pedicels singly or in opposite pairs at the bends. Pedicels rather long and annulated throughout, the stem also more extensively annulated than in most species of the genus. Hydrothecæ very large, deep, tubular, with very shallow undulations around the margin, from between which lines run down for a short distance on the surface of the hydrothecæ.

Gonosome.—Unknown.

Distribution.—Orca, Alaska (Harriman Exped.).

This species bears some resemblance to *O. bidentata* Clark, found on the New England Coast, but differs in the nature of the hydrothecal teeth which are mere sinuosities, instead of being mucronate with two denticles each as in the latter species.

HEBELLA.

Trophosome.—Pedicels arising from a creeping rootstock, very short. Hydrothecæ tubular, with entire margins, without opercula, and having their cavities separated from those of the stems by a partial septum. Hydranths with a conical proboscis.

This genus was originally instituted by Allman.[1] As here defined it includes several species heretofore included in the genus *Lafœa.*

HEBELLA POCILLUM (Hincks).

Lafœa pocillum HINCKS, British Hydroid Zoophytes, p. 204, 1868.—CLARK, Proc. Acad. Nat. Sciences, Philadelphia, p. 215, 1876.—VERRILL, Preliminary check-list Marine Vertebrates of Atlantic coast, p. 17, 1879.—BERGH, Goplepolyper (Hydroider) fra Kara-Havet, p. 333, 1887.

Distribution.—Kadiak, Alaska (Harriman Exped.); Nunivak Island, Alaska (Clark); Kara Sea (Bergh); British Coasts (Hincks); New England Coast (Verrill).

GONOTHYRÆA.

Trophosome.—Much as in *Obelia.*

Gonosome.—Planulæ produced in sessile medusaform gonophores which remain attached to the top of the gonangia until the spermatozoa or planulæ are discharged.

GONOTHYRÆA INORNATA sp. nov.

(Plate IX, figs. 2–4.)

Trophosome.—Colony attaining a height of about two inches and consisting of a main stem which almost immediately breaks up into a number of very slender, erect, almost straight branches which are ornamented with about three annulations immediately above the origins of the pedicels. Pedicels alternate, erect, much broader below than above and with seven to ten annulations. Hydrothecæ funnel-shaped, with entire margins.

Gonosome.—Gonangia borne in the axils of the pedicels, slender, obconic, with a tendency to annulation. Each gonangium contains a single sporosac which when mature rests upon the summit of the gonangium and has little indication of radial canals or tentacles.

Distribution.—Yakutat Bay, Alaska (Harriman Exped.).

This species differs from others of the genus in having but one sporosac to each gonangium and in the obliteration of most of the medusoid characters of the sporosac. The entire margin of the hydrotheca is also an exceptional character.

[1] Allman, Challenger Report, Hydroida, Second Part, p. 29, 1888.

Family *CAMPANULINIDÆ*.

Trophosome.—Colonies branched or unbranched. Hydrothecæ borne on pedicels, tubular, ending in an operculum composed of several converging segments or triangular flaps. Hydranth with a conical proboscis.

Gonosome.—Gonangia producing free medusæ or planulæ.

CAMPANULINA.

Trophosome.—Hydrothecæ thin-walled, the upper portion cleft so as to produce very long and slender teeth which form an operculum by the convergence of their free ends.

Gonosome.—Gonangia producing bell-shaped medusæ, with four radial canals, two or four marginal tentacles, and eight lithocysts.

CAMPANULINA RUGOSA sp. nov.

(Plate XXII, figs. 1, 2.)

Trophosome.—Colony attaining a height of about ½ inch. Stem irregularly branched; branches tending to an alternate arrangement, straggling, geniculate; stem and branches strongly and regularly annulated throughout. Pedicels very short, with three to six annulations. Hydrothecæ ovoid-oblong, the distal third being composed of the operculum consisting of ten or twelve segments. The hydranths have about sixteen tentacles.

Gonosome.—Gonangia in axils of the pedicels and branches, sometimes aggregated on certain branches to the exclusion of hydrothecæ. They are oblong-ovoid in shape and somewhat flattened on their distal ends. Each gonangium contains a single medusa when mature.

Distribution.—Juneau, Alaska (Harriman Exped.). The specimens were found growing on *Obelia*.

CALYCELLA.

Trophosome.—Stem a creeping rootstock sending forth short annulated pedicels. Hydrothecæ tubular, thick-walled, with opercula that are distinct from the hydrothecal teeth, and composed of several triangular segments.

Gonosome.—Gonangia borne on the rootstock, and, when mature, bearing acrocysts.

CALYCELLA SYRINGA (Linn.).

Sertularia syringa LINN., Systema Naturæ, Ed. XII, Tom. I, Pars II, p. 1311, 1767.

Calycella syringa Clark, Proc. Acad. Nat. Sciences, Philadelphia, p. 210, 1876.—Verrill, Preliminary Check-list Marine Invertebrata Atlantic Coast, p. 17, 1879.—Bergh, Goplepolyper (Hydroider) fra Kara-Havet, p. 335, 1887.—Nutting, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. xxi, p. 741, 1899.

Distribution.—Berg Inlet and Kadiak, Alaska (Harriman Exped.); Coal Harbor, Shumagin Islands, Alaska (Clark); Kara Sea (Bergh); British Coasts (Hincks); New England Coast (Verrill); Puget Sound (Nutting).

Family *LAFŒIDÆ.*

Trophosome.—Hydrothecæ tubular, margins without teeth or opercula, the hydrothecal cavity not divided from the stem cavity by a partial septum.

Gonosome.—Gonangia forming a 'Coppinia' mass.

LAFŒA.

Trophosome.—Colony with a fascicled stem, and with hydrothecæ either free or partially immersed in the stem, the distal portion not being abruptly turned upward.

Gonosome.—A 'Coppinia' mass.

LAFŒA DUMOSA (Fleming).

Sertularia dumosa Fleming, Edinburgh Phil. Jour., ii, p. 83, 1828.

Lafœa dumosa Sars, Bidrag til Kundskaben om Norges Hydroider, p. 45, 1873.—Clark, Proc. Acad. Nat. Sciences, Philadelphia, p. 210, 1876.—Verrill, Preliminary Check-list Marine Invertebrates of Atlantic Coast, p. 17, 1879.—Nutting, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. xxi, p. 741, 1899.

Distribution.—Dutch Harbor, Unalaska (Harriman Exped.); Port Etches, Alaska (Clark); North Cape, Norway (Sars); British Coast (Hincks); New England Coast (Verrill); Puget Sound (Nutting); California Coast (Clark).

LAFŒA GRACILLIMA (Alder).

Campanularia gracillima Alder, Catalogue Zoophytes of Northumberland and Durham, Trans. Tyneside Naturalists' Field Club, p. 39, 1857.

Lafœa gracillima Clark, Proc. Acad. Nat. Sciences, Philadelphia, p. 216, 1876.—Verrill, Preliminary Check-list Marine Invertebrates of Atlantic Coast, p. 17, 1879.—Marktanner-Turneretscher, Hydroiden von Ost-Spitzbergen, Zoolog. Jahrbuch., Vol. viii, p. 410, 1895.—Nutting, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. xxi, p. 741, 1899.

Distribution.—Juneau, Berg Inlet and Orca, Alaska (Harriman Exped.); Shumagin Islands, Alaska (Clark); British Coast (Alder);

Spitzbergen (Marktanner-Turneretscher); New England Coast (Verrill); Puget Sound (Nutting).

LAFŒA FRUTICOSA M. Sars.

Lafœa fruticosa M. Sars, Bemærkninger over 4 norske Hydroider Vid. Selsk. Forh., 1862.—G. O. Sars, Bidrag til Kundskaben om Norges Hydroider, p. 26, 1873.—Clark, Proc. Acad. Nat. Sciences, Phila., p. 216, 1876.

Distribution.—Juneau, Berg Inlet and Kadiak, Alaska (Harriman Exped.); Kiska Harbor, Shumagin Islands, Alaska (Clark); British Coasts (Hincks); Lofoten, Norway (G. O. Sars); New England Coast (Verrill); Puget Sound (Nutting, MSS.).

LAFŒA ADHÆRENS sp. nov.

(Plate x[illegible], figs. 3, 4.)

Trophosome.—Colony forming an encrusting mass of adherent rootstocks disposed both longitudinally and transversely over colonies of other Hydroids, the tubes of the rootstock interwoven much like the threads of a fabric. Hydrothecæ sessile, tubular, often more or less curved, aperture facing upward, entire; margin slightly expanded. The hydrothecæ are very irregularly disposed, being much more crowded in some places than in others.

Gonosome.—The 'Coppinia' mass is much like that of *Lafœa dumosa*, being composed of closely packed gonangia interspersed with long, tubular, variously curved modified hydrothecæ. The gonangia are flask-shaped, with a tubular neck and small aperture. Each gonangium apparently contains a single ovum.

Distribution.—Kadiak Harbor, Alaska. Growing over stems of *Thuiaria turgida* (Harriman Exped.).

This interesting species is so different in appearance from the others of the genus that I was at first inclined to make it the type of a new genus.

GRAMMARIA.

Trophosome.—Stem fascicled, composed of an axial tube from which the hydrothecæ spring and to which they are partly adnate, completely enclosed by a definite number of peripheral nonhydrothecate tubes.

Gonosome.—A 'Coppinia' mass.

GRAMMARIA IMMERSA sp. nov.

(Plate xxi, figs. 5, 6.)

Trophosome.—Stem rigid, erect, giving forth scattered, stiff and straight, alternate branches forming nearly a right angle with the stem.

Height of a fragmentary specimen about ¾ inch. Stem and branches sharply constricted proximally, composed of an axial tube which gives off the eight or nine series of hydrothecæ, and a number of peripheral tubes enclosing the axial tube completely, thus burying all the hydrothecæ nearly to their distal ends. Hydrothecæ arranged in about eight or nine longitudinal series, forming spirals. The distal ends of the hydrothecæ are abruptly bent outward, so that the round, even aperture is vertical. When the peripheral tubes are removed the hydrothecæ are seen to be long, tubular, doubly curved, narrowing proximally, but without true pedicels, and all springing from the axial tube.

Gonosome.—Unknown.

Distribution.—St. Paul harbor, Kadiak (Harriman Exped.).

FILELLUM.

Trophosome.—Stem a creeping, slender rootstock, parasitic on other hydroids, often forming a reticulate structure. Hydrothecæ curved, decumbent, and partly adherent; margin entire, without operculum.

Gonosome.—A 'Coppinia' mass.

FILELLUM SERPENS (Hassell).

Campanularia serpens HASSELL, Zoologist, No. 69, p. 2223.
Filellum serpens SARS, Bidrag til Kundskaben om Norges Hydroider, p. 29, 1873.—VERRILL, Preliminary Check-list Marine Invertebrates of Atlantic Coast, p. 17, 1879.

Distribution.—Juneau, Alaska (Harriman Exped.); British Coast (Hassell); Lofoten, Norway (Sars).

Family *HALECIDÆ.*

Trophosome.—Hydrothecæ reduced to the form of saucer-shaped or collar-like hydrophores, usually borne on broad tubular pedicels; margins even, often reduplicated. Hydranths large, incapable of retracting within the hydrophores, and with a conical or dome-shaped proboscis.

Gonosome.—Gonangia producing planulæ, and usually differing in the two sexes.

HALECIUM.

Trophosome.—No specialized defensive 'persons' developed.

Gonosome.—Female gonangia often surmounted by a pair of hydranths.

HALECIUM HALECINUM (Linn.).

Sertularia halecina LINN., Systema Naturæ, Ed. x, p. 809, 1758.

Halecium halecinum VERRILL, Preliminary Catalogue Marine Invertebrates Atlantic Coast, p. 17, 1879.—MARKTANNER-TURNERETSCHER, Hydroiden von Ost-Spitzbergen, p. 428, 1895.—NUTTING, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. XXI, p. 741, 1899.

Distribution.—Kadiak, Alaska (Harriman Exped.); British Coast (Hincks); Greenland (Marktanner-Turneretscher); New England Coast (Verrill); Puget Sound (Nutting).

HALECIUM MURICATUM (Ellis and Solander).

Sertularia muricata ELLIS AND SOLANDER, Nat. Hist. Zoophytes, p. 59, 1786.
Halecium muricatum VERRILL, Preliminary Check-list Marine Invertebrates Atlantic Coast, etc., p. 17, 1879.—LEVINSEN, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, p. 61, 1893.—CLARK, Proc. Acad. Nat. Sci., Philadelphia, p. 217, 1876.

Distribution.—Orca, Alaska (Harriman Expd.); British Coasts (Ellis and Solander); Greenland (Levinsen); New England Coast (Verrill).

HALECIUM SCUTUM Clark.

Halecium scutum CLARK, Proc. Acad. Nat. Sci., Philadelphia, p. 218, 1876. —BONNEVIE, Norwegian N. Atlan. Exped., p. 57, 1899.

Distribution.—Berg Inlet and Yakutat, Alaska (Harriman Exped.); Unalaska (beach) and Shumagin Islands, Alaska (Clark); North Cape, Norway (Bonnevie).

HALECIUM REVERSUM sp. nov.

(Plate XXIII, figs. 1, 2.)

Trophosome.—Colony attaining a height of about one inch. Main stem fascicled, branches simple and alternate, making a flabellate colony. Nonfascicled part of the stem and branches divided into internodes, each of which bears one or two pedicels springing from its *proximal* portion. Pedicels long, of even diameter throughout, often rugose on proximal portion. Hydrophores with large everted margins and a distinct row of dots. Reduplication of margins distant, when present. Hydranth small for this genus, with about twenty tentacles.

Gonosome.—Not present in type specimen.

Distribution.—Juneau, Alaska (Harriman Exped.).

This species possesses the very exceptional, if not unique, character of having the pedicels spring from the proximal part of the internode instead of the distal portion, as in all other species of *Halecium* with which I am acquainted. This character appears to be constant. The specimen was dredged from a depth of twenty fathoms.

HALECIUM ORNATUM sp. nov.

(Plate XXII, figs. 3, 4.)

Trophosome.—Colony parasitic, branching irregularly. Stems not fascicled, the stem and branches sparsely and irregularly annulated. Pedicels long, of equal diameter throughout. Hydrophores with broad, everted margins, occasionally reduplicated. Hydranth large, with twenty-four to thirty tentacles.

Gonosome.—A single apparently young gonangium was borne on a pedicel just below the hydrophore. It was in form a truncated and deeply annulated cone. Probably the mature gonangium would resemble that found in the next species.

Distribution. — Berg Inlet, Glacier Bay, Alaska. Growing on *Lafœa gracillima* (Harriman Exped.).

HALECIUM SPECIOSUM sp. nov.

(Plate XXII, figs. 1, 2.)

Trophosome.—Colony small, attaining a height of about ⅓ inch. Stem not fascicled, the main stem and branches apparently formed of series of stout pedicels, each giving origin to another pedicel just below the hydrophore. The pedicels thus take the place of stem joints, bending alternately to the right and left, giving a geniculate appearance to the series. Pedicels broad, corrugated proximally and smooth distally. Hydrophores large, with broadly expanded but not everted margins, and a well marked row of dots. There appears to be no reduplication of the margins. Hydranths very large with twenty-four to thirty short tentacles, a broad oral disk occupied by the low dome-shaped proboscis.

Gonosome.—Gonangia borne on rather long annulated pedicels below the hydrophores, particularly on the upper part of the colony; regularly ovoid in outline, and evenly and beautifully annulated throughout.

Distribution.—Yakutat Bay, Alaska (Harriman Exped.).

This is the most strikingly ornamented species of *Halecium* known to the writer. Its manner of growth is exceptional, although not unknown among its allies, and the hydranth is more like the polyp of some actinozoon than of a hydroid. The gonangia are beautiful structures. They seemed to be filled with a granular, ovoid mass, probably a single large sporosac.

HALECIUM ROBUSTUM sp. nov.

(Plate XXIII, figs. 3, 4, 5.)

Trophosome.—Stem very thick and fascicled, consisting of an immense number of wavy tubes. In the single specimen collected, the main stem divides near its base into three heavy fascicled branches, which themselves branch and subdivide extensively, the fasciculation continuing nearly to the tips of the branches. The entire height of the colony is about three inches. The branching is so profuse that the arrangement of the internodes is obscure. The ultimate branches give off short pedicels and sessile hydrophores in what appear to be clusters or whorls. Pedicels short, tubular, ending in an exceedingly shallow hydrophore. Hydrophores reduced to a mere narrow rim, marked by the internal diaphragm and circlet of dots, the only distinction between pedicel and hydrophore, as the margin of the latter is not appreciably everted. Most of the hydrophores are sessile, being set on mere shoulders of the branch from which they grow. The circlet of dots can only be made out with great difficulty and the use of high magnification. Hydranths exceedingly numerous and large, covering the branches so as to almost entirely conceal them from view. Tentacles about twenty, surrounding a low conoid proboscis.

Gonosome.—Unknown.

Distribution.—Berg Inlet, Glacier Bay, Alaska (Harriman Exped.).

This species bears some relation to *Halecium densum* Calkins,[1] but differs from that species in the hydrophores, which are not reduplicated and have straight, not everted, margins. The hydranths are so crowded that a branch resembles an expanded colony of Alcyonaria, and appears to be made up entirely of hydranths.

Family *SERTULARIDÆ.*

Trophosome.—Hydrothecæ sessile, more or less adnate by their side to the stem and branches upon which they grow; always in more than one longitudinal row on each branch, the arrangement usually biserial. Hydranth with a conical proboscis.

Gonosome.—Reproduction always by means of planulæ, which are developed within the gonangia. No medusæ.

SERTULARELLA.

Trophosome.—Stem and branches divided into regular internodes, each bearing one or two hydrothecæ; nodes oblique. Hydrothecæ

[1] Proc. Boston Soc. Nat. Hist., Vol. 28, no. 13, p. 343, 1899.

alternate, borne on opposite sides of the stem and branches. Margin usually more or less toothed, aperture usually provided with an operculum consisting of more than one segment.

SERTULARELLA TRICUSPIDATA (Alder).

Sertularia tricuspidata ALDER, Catalogue of the Zoophytes of Northumberland and Durham, Trans. Tyneside Naturalists' Field Club, p. 21, 1857.
Cotulina tricuspidata A. AGASSIZ, North American Acalephæ, p. 146, 1864.
Sertularella tricuspidata CLARK, Proc. Acad. Nat. Sciences Phila., p. 224, 1876.—MARKTANNER-TURNERETSCHER, Hydroiden von Ost-Spitzbergen, p. 425, 1895.—NUTTING, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. XXI, p. 741, 1899.

Distribution.—Juneau, Berg Inlet, and Yakutat, Alaska (Harriman Exped.); Shumagin Islands, Semidi Islands, Unalaska, Port Etches, and Kiska Harbor, Alaska (Clark); British Coast (Alder); New England Coast (A. Agassiz); Greenland (Marktanner-Turneretscher); Puget Sound (Nutting).

SERTULARELLA POLYZONIAS (Linn.).

Sertularia polyzonias LINN., Systema Naturæ, Ed. X, p. 813, 1758.
Sertularella polyzonias GRAY, List of the Specimens of British Animals in the British Museum, part I, Radiata, London, 1847.—SARS, Bidrag til Kundskaben om Norges Hydroider, p. 44, 1873.—CLARK, Proc. Acad. Nat. Sci. Phila., p. 224, 1876.
Cotulina polyzonias AGASSIZ, Contributions to the Natural History of the United States, Vol. IV, p. 356, 1864.
Sertularella conica CALKINS, Some Hydroids from Puget Sound, Proc. Boston Soc. Nat. Hist., Vol. XXVIII, p. 359, 1899.

Distribution.—Orca, Alaska (Harriman Exped.); Port Etches and Nunivak Island, Alaska (Clark); British Coasts (Gray); North Cape, Norway (Sars); New England Coast (Agassiz); Puget Sound (Calkins).

Calkins, in the reference cited above, identifies a small specimen otherwise identical with *S. polyzonias*, as the species *S. conica* Allman, and says: "The only character, and that a small one, by which to distinguish it from the very wide-spread *S. polyzonias* is the well-marked wrinkling on the adcauline side of the hydrotheca." Specimens from Alaska in the Harriman Collection, agreeing with Calkins's description and figures, have the characteristic gonosome of *S. polyzonias*, and I therefore consider that I am justified in regarding his specimen as belonging to that species.

SERTULARELLA SACCATA sp. nov.

(Plate XXIV, figs. 1–3.)

Sertularella rugosa CLARK, Proc. Acad. Nat. Sci. Phila., p. 224, 1876.

Sertularella geniculata MARKTANNER-TURNERETSCHER, Die Hydroiden Des k. k. naturhistorischen Hofmuseums, p. 222, 1890.

Trophosome.—Colony consisting of a sparingly branched, nonfascicled stem attaining a height of about one inch. Stem annulated and nonhydrothecate proximally, otherwise bearing alternate hydrothecæ, one to each internode; stems and branches erect. Hydrothecæ roughly ovate in general outline, with a laterally inclined, broad, smooth, round neck or collar surmounted by a four-toothed aperture and a four-flapped operculum; below the neck the body of the hydrotheca has three or four broad annular corrugations. Hydranths with about sixteen tentacles.

Gonosome.—Gonangia large, oblong-ovate in general outline, with several, seven to nine, broad annular corrugations. The mature ova are enclosed in an ovoid acrocyst resting on the top of the gonangium.

Distribution. — Popof Island, Alaska (Harriman Exped.); Unalaska, Shumagin Islands, St. Paul Island and Nunivak Island, Alaska (Clark); Jan Mayen (Marktanner-Turneretscher).

The specimens of this species secured by the Harriman Expedition agree well with the figure given by Clark of specimens that he identified as *S. rugosa*. The very conspicuous neck, however, would seem to be sufficient to distinguish *S. saccata* from *S. rugosa*, and the same difference exists between the gonangia of the two forms. The figure given by Marktanner-Turneretscher for *S. geniculata* Hincks differs greatly from Hincks's original description and figure, and agrees well with the present species, except that the hydrothecæ are more closely approximated in the latter.

THUIARIA.

Trophosome.—Colony branched, the branches divided into unequal internodes, each bearing several pairs of opposite or subopposite hydrothecæ. Hydrothecæ usually deeply immersed in the stem or branch to which they are attached. The branches are alternate, and each springs from an unpaired hydrotheca.

Gonosome.—Much as in *Sertularia*.

THUIARIA ARGENTEA (Ellis and Solander).

Sertularia argentea ELLIS and SOLANDER, The Natural History of many curious and uncommon Zoophytes, etc., p. 38, 1786.—CLARK, Hydroids of the Pacific Coast of the United States south of Vancouver Island, Trans. Conn. Acad., Vol. III, p. 251, 1876.—VERRILL, Preliminary Check-list Marine Invertebrates Atlantic Coast, etc., p. 18, 1879.—BERGH, Goplepolyper (Hydroider) fra Kara-Havet, p. 335, 1887.—NUTTING, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. XXI, p. 741, 1899.

Distribution.—Yakutat, Alaska (Harriman Exped.) ; British Coast (Ellis and Solander) ; Kara Sea (Bergh) ; New England Coast (Verrill) ; Puget Sound (Nutting) ; California (Clark).

THUIARIA SIMILIS (Clark).

Sertularia similis CLARK, Proc. Acad. Nat. Sci. Phila., p. 219, 1876.

Distribution.—Berg Inlet, Glacier Bay, Alaska (Harriman Exped.) ; Hagmeister Island, Alaska (Clark) ; Puget Sound (Nutting, MSS.).

THUIARIA VARIABILIS (Clark).

Sertularia variabilis CLARK, Proc. Acad. Nat. Sci. Phila., p. 221, 1876.

Distribution.—Orca, Alaska (Harriman Exped.) ; numerous stations in Alaska (Clark) ; San Miguel Island, California (Clark) ; Puget Sound (Nutting, MSS.).

THUIARIA CUPRESSOIDES (Clark).

Sertularia cupressoides Clark, Proc. Acad. Nat. Sci. Phila., p. 220, 1876.

Distribution.—Yakutat, Alaska (Harriman Exped.) ; Shumagin Islands and Port Moller, Alaska (Clark).

THUIARIA COEI sp. nov.

(Plate XXVI, figs. 1–3.)

Trophosome.—Colony consisting of a single flexuous stem giving forth regularly alternate branches. Stem three inches high, and divided into irregular internodes each bearing a branch and two hydrothecæ on one side and one hydrotheca on the other. Branches divided into irregular internodes, each usually bearing several pairs of hydrothecæ. Hydrothecæ subopposite, turgid basally, narrowing distally to a horizontal aperture which is pointed on its outer side. An upward projecting point of chitine at the bottom of each hydrotheca.

Gonosome.—Gonangia top-shaped, or obconical, with a pronounced round collar and rather broad aperture. Proximal portion broadly corrugated, and narrowing basally to a short curved pedicel.

Distribution. — Dutch Harbor, Alaska (W. R. Coe, Harriman Exped.).

This is a very distinct species, and the top-shaped gonangia are quite different from any others of the genus that I have seen.

THUIARIA FABRICII (Levinsen).

(Plate XXIV, figs. 4, 5.)

Sertularia fabricii LEVINSEN, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, p. 48, 1893.—CALKINS, Some Hydroida from Alaska and Puget Sound, Proc. Boston Soc. Nat. Hist., Vol. XXVIII, p. 361, 1899.

Distribution.—Dutch Harbor, Alaska (Harriman Exped.); Greenland (Levinsen); Puget Sound (Calkins).

A specimen in the Harriman collection agrees perfectly with the descriptions and figures of both Levinsen and Calkins. I have directly compared it with specimens of *Sertularia argentea* from England, and find that the two species are evidently distinct, *T. fabricii* differing from *S. argentea* in the following particulars. The colony is much more bushy in appearance, and more compactly branched. The hydrothecæ are more nearly in pairs, and much more closely approximated, are more densely corneous and have a more delicate and less clearly defined aperture. The gonangia are considerably larger and of thinner texture, and are only occasionally armed with lateral spines.

It should be explained that Levinsen regards his *Sertularia fabricii* as identical with the *Sertularia argentea* of authors, and gives it the name *S. fabricii*. My opinion is that the species is distinct, and I recognize the name given by him because he has correctly described and figured the species, although not classing it as distinct. It should, however, be placed in the genus *Thuiaria*, for it comes well within that genus as here defined.

THUIARIA TURGIDA Clark.

(Plate xiv, figs. 4–6.)

Thuiaria turgida Clark, Proc. Acad. Nat. Sci. Phila., p. 229, 1876.—Nutting, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. xxi, p. 741, 1899.

Distribution.—Sitka, Orca, Popof Island, and Dutch Harbor, Alaska (Harriman Exped.); Port Etches, Shumagin Islands, Semidi Islands, and many other points in Alaska (Clark).

THUIARIA GIGANTEA Clark.

Thuiaria gigantea Clark, Proc. Acad. Nat. Sci. Phila., p. 230, 1876—Nutting, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. xxi, p. 741, 1899.

Distribution. — Kadiak and Popof Island, Alaska (Harriman Exped.); St. Paul Island, Hagmeister Island, Unalaska and Kiska Harbor, Alaska (Clark); St. Paul Island (Nutting).

THUIARIA THUIARIOIDES (Clark).

Sertularia thuiarioides Clark, Proc. Acad. Nat. Sci. Phila., p. 223, 1876.

Distribution.—Yakutat, Alaska (Harriman Exped.); Nunivak Island and Chignik Bay, Alaska (Clark).

THUIARIA ELEGANS sp. nov.

(Plate xxv, figs. 1–3.)

Trophosome.—Colony consisting of a central nonfascicled stem branching in a plumose manner and attaining a height of about six inches. Stem bearing hydrothecæ throughout its length, divided by oblique nodes into long and irregular internodes, each of which usually bears three or four branches; branches alternate, pinnately arranged, unbranched proximally, and distally dividing into a number of branchlets; internodes of stem irregular, but each bearing normally more than one pair of hydrothecæ. Hydrothecæ subalternate, short, pitcher-shaped, with a double curve in front and an even aperture much like the top of a pitcher; operculum composed of a single flap.

Gonosome.—Gonophores borne on the upper sides of the distal ends of the branches in a closely set double row. The individual gonangium is slender, oblong-oval, with a truncated top, an internal distal plug which appears as a dark collar, and an internal mass of developing sex elements.

Distribution.—Berg Inlet, Glacier Bay, 20 fathoms; Dutch Harbor, Alaska (Harriman Exped.).

THUIARIA COSTATA sp. nov.

(Plate xxvi, figs. 4–9.)

Trophosome.—Colony usually a single stem giving forth alternate branches, the whole having a plumose appearance, stem simple, straight, the lower part composed of regular internodes, each bearing a pair of subopposite hydrothecæ, the upper part divided into regular internodes, each bearing a branch and three hydrothecæ; nodes oblique. Branches alternate and themselves branching dichotomously, divided into unequal internodes, each bearing more than two subopposite hydrothecæ. Hydrothecæ turgid below and narrowing above into a short neck which ends in a round aperture facing upward. A chitinous spine projects downward from the lower inner side of each hydrotheca.

Gonosome.—Gonangia borne profusely on both faces of the stem and often on the proximal ends of the branches; oblong-ovate, with a short, small neck and round terminal aperture, the gonangia are ornamented with about five compressed longitudinal ridges, the crests of which are colored black. General color of the gonangia orange brown.

Distribution.—Yakutat, Alaska. Abundant (Harriman Exped.).

This species resembles *Sertularia inconstans* Clark, but differs considerably, particularly in its gonosome, which is very strongly marked.

Family *PLUMULARIDÆ.*

Trophosome.—Hydrothecæ cup-shaped, usually more or less adnate to the stem or branches, and always arranged on one side only of the hydrocladia, or branches, on which they grow. Nematophores present.

Gonosome.—Reproduction by means of planulæ. No medusæ.

PLUMULARIA.

Trophosome.—Hydrocladia unbranched alternate, nematophores on slender pedicels; hydrothecæ without marginal teeth. Stem not canaliculated.

Gonosome.—Gonangia oval, without corbulæ or protective structures of any kind.

PLUMULARIA LAGENIFERA Allman.

Plumularia lagenifera ALLMAN, Jour. Linn. Soc. Zool., XIX, p. 157, 1885.—NUTTING, American Hydroida, Part I, The Plumularidæ, p. 65, 1900.

Plumularia californica MARKTANNER TURNERETSCHER, Annalen des k. k. Naturhist. Hofmuseums, V, No. 2, p. 255, 1890.—NUTTING, Hydroida from Alaska and Puget Sound, Proc. U. S. Nat. Mus., Vol. XXI, p. 741, 1899.

Distribution.—Berg Inlet, Popof Island, Alaska (Harriman Exped.); Puget Sound (Nutting); Coast of California (Nutting).

PLUMULARIA PALMERI Nutting.

Plumularia palmeri NUTTING, American Hydroida, Part I, The Plumularidæ, p. 65, 1900.

Distribution.—Victoria, B. C. (Harriman Exped.); San Diego. California (Nutting).

This is the only species in the collection that was not from Alaska. It seemed best to include it in the list, particularly as a new locality is thereby noted.

BIBLIOGRAPHY.

The following list includes all the publications referred to in this Report on Hydroida. It does not include papers that were consulted and found to contain nothing pertinent to the immediate subject of the report.

Agassiz, Alexander.

1865. North American Acalephæ. Illustrated Catalogue, Museum Comparative Zoology, No. II.

Agassiz, Louis.

1862. Contributions to the Natural History of the United States, IV.

Alder, Joshua.

1857. A Catalogue of the Zoophytes of Northumberland and Durham. Trans. Tyneside Naturalists' Field Club.

Allman, G. J.

1859. Notes on the Hydroid Zoophytes. Annals and Mag. Nat. Hist., Third Series, Vol. IV, pp. 52 and 141.

1864. On the Constuction and Limitation of Genera among the Hydroida. Annals and Mag. Nat. Hist., Third Series, Vol. XIII, No. 77.

1870–1872. Monograph of the Gymnoblastic or Tubularian Hydroids, Ray Society.

1888. Report on the Hydroids dredged by H. M. S. Challenger, Part 2.

1885. Description of Australian, Cape and other Hydroids, mostly new, from the collection of Miss H. Gatty. Journ. Linnæan Society, Vol. XIX.

Bergh, R. S.

1887. Goplepolyper (Hydroider) fra Kara-Havet.

Bonnevie, Kristine.

1898 Zur Systematik der Hydroiden. Zeitschr. Wissen. Zoologie, Jahrb. 63.

1899. Hydroida of the Norwegian North Atlantic Expedition.

Calkins, G. M.

1899. Some Hydroids from Puget Sound. Proc. Boston Soc. Nat. Hist., Vol. XXVIII, No. 13.

Clark, S. F.

1876. Report on the Hydroids collected on the Coast of Alaska and the Aleutian Islands, by W, H. Dall. Proc. Acad. Nat. Sciences, Philadelphia.

1876. Description of New and Rare Species of Hydroids from the New England Coast. Trans. Conn. Acad. Sci., III.

1876. The Hydroids of the Pacific Coast of the United States, South of Vancouver Island. Trans. Conn. Acad. Sci., III.

Ellis and Solander.

1786. The Natural History of many Curious and Uncommon Zoophytes.

Fleming, J.

1828. A History of British Animals. Edinburgh Philos. Journ., XIII.

Hartlaub, Clemens.

Die Hydromedusen Helgolands. Wissench. Meeresuntersuchungen. II Band.

Hincks, Rev. Thomas.

1868 British Hydroid Zoophytes

1880 On New Hydroida and Polyzoa from Berent's Sea. Annals and Mag. Nat. Hist,, Fifth Series, VI.

Kirchenpauer, G. H.

1884. Nordische Gattungen und Arten von Sertulariden. Abhand. a. d. Geb. d. Naturwiss., herausgegeb. vom Naturwiss., Verein, VIII, Pt. 3.

Lamarck, J. B. P. A. de.

1836. Histoire Naturelle des Animaux sans Vertebres, 2d Edition.

Lendenfeld, R. von.

1883 Über Coelenteraten der Sudsee, V. Mittheilung. Zeitschrift fur Wissensch. Zoologie, XXXVIII.

Levinsen, G. M. R.

1886 Annulata, Hydroida, Anthozoa, Porifera, in : Vid. Udbytte af Kanonbaaden, Haucks Togter i.

1892 Om Fornyelsen af Ernæringsindividerne hos Hydroiderne. Særtryk af Vidensk. Meddel. fra den naturhist. Fornening i Kbhvn.

1893 Meduser, Ctenophorer, og Hydroider fra Grönlands Vestkyst, Copenhagen.

Linnæus, C.

1758 Systema Naturæ, 10th Edition.

1767 Systema Naturæ, 12th Edition, Pt. II.

Marktanner-Turneretscher, Gottlieb.

1890 Die Hydroiden des k. k. Naturhist. Hofmuseums, V.

1895 Hydroiden von Ost-Spitzbergen. Zool. Jahrb., VIII. Abth.

Mereschkowsky, C.

1878 New Hydroida from Ochotsk, Kamtschatka, and other parts of the North Pacific Ocean. Annals and Mag. Nat. Hist., Dec.

Nutting, C. C.

1899 Hydroida from Alaska and Puget Sound. Proc. U. S. Nat. Museum, Vol. XXI, No. 1171.

1900 American Hydroids, Part I., The Plumularidæ. U. S. Nat. Museum, Special Bulletin No. 4.

Sars, M. (?)

1862 Bemærkninger over fire norske Hydroider; Vid. Selsk. Forh.

1873 Bidrag til Kundskaben om norges Hydroider.

Schultz, Franz Eilhard.

1872 Nordsee Expedition, III, Cœlenteraten.

Schneider, K. C.

1897 Hydropolypen von Rovigno, nebst übersicht über das system der Hydropolypen in allgemeinen. Zool. Jahrb., Syst. abth. bd., 10.

Segerstedt, M.

1899 Bidrag til Kannedomen om Hydroid-Faunen ved Sveriges Vestkust, Stockholm.

Verrill, A. E.

1873 Brief Contributions to Zoology from the Museum of Yale College, No. XXIII, American Journal of Science.

Verrill, A. E.

1874 Invertebrate Animals of Vineyard Sound.

1879 Preliminary Check List of the Marine Invertebrates of the Atlantic Coast, from Cape Cod to the Gulf of St. Lawrence.

Winther, Georg.

1879 Fortegnelse over de i Danmark og dets Nordlige Bilande fundne Hydroide Zoophyter.

Wright, J. Strethill.

1859 Observations on British Zoophytes. Edinburgh New Philos. Journ., New series, Vol. VII.

PLATE III.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XIV.]

FIG. 1. *Coryne brachiata* Nutting. Part of colony.
2. Single gonophore (enlarged).
3. *Syncoryne eximia* Allman. Part of colony.
4. Single hydranth with budding medusa.

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PLATE IV.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XV.]

FIG. 1. *Garveia annulata* Nutting. Part of colony, showing hydranths and gonophores.

2. Single hydranth, showing pseudo-hydrotheca (enlarged).
3. *Eudendrium vaginatum* Allman. Part of colony, showing hydranths and gonophores.
4. Single hydranth, showing pseudo-hydrotheca (enlarged).
5. Cluster of female gonophores.
6. Single gonophore, with expanded chitinous collar (enlarged).

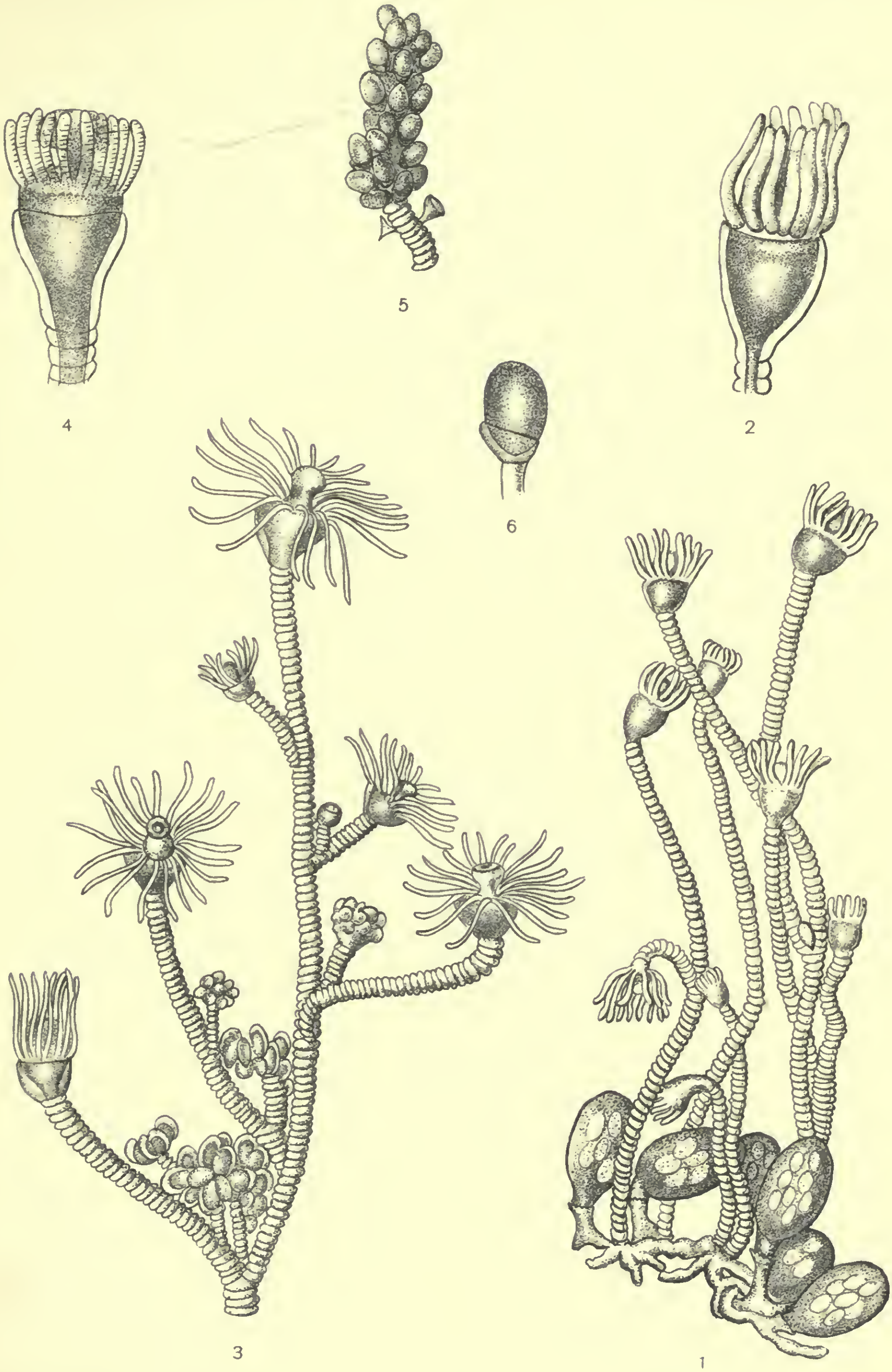

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PLATE V.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XVI.]

FIG. 1. *Tubularia harrimani* Nutting. Single hydranth with gonophores.
2. Three gonophores, showing apical tentacles and developing actinule (enlarged).

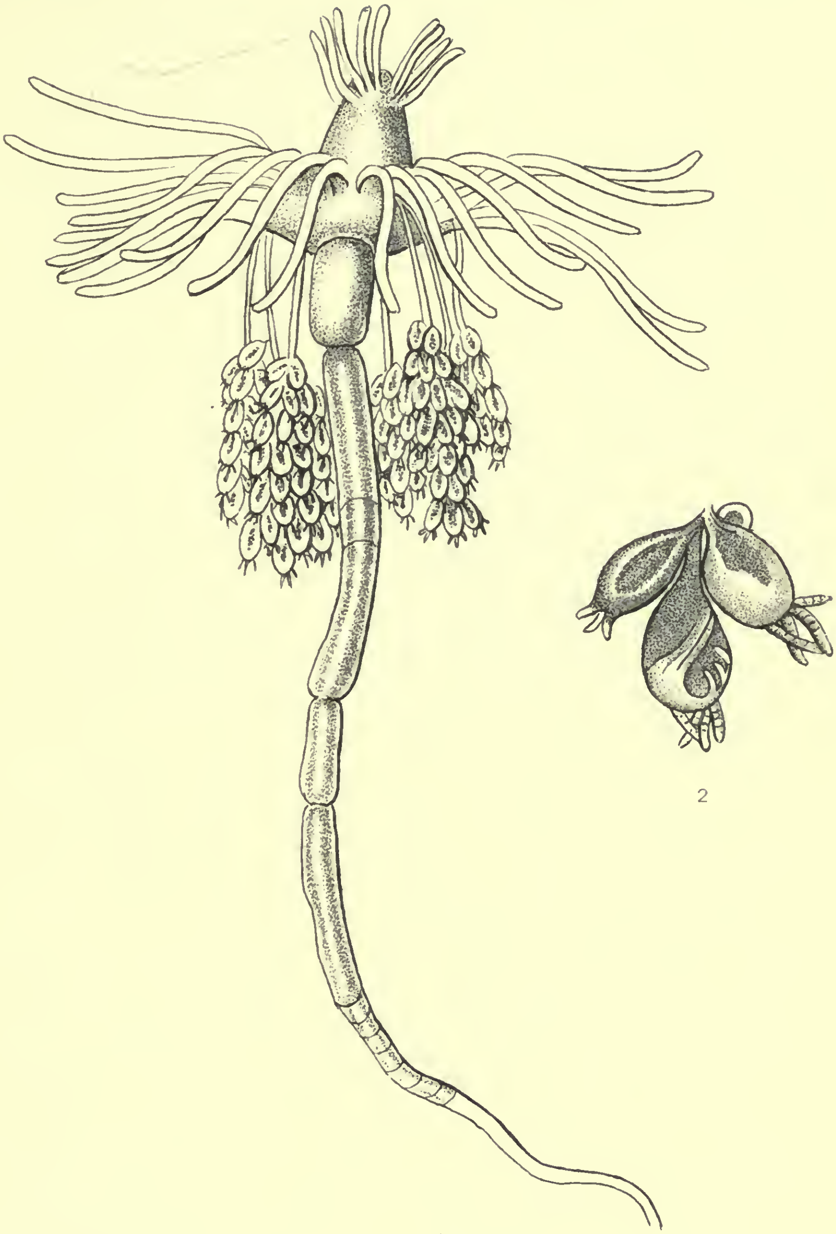

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PLATE VI.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XVII.]

FIG. 1. *Clytia caliculata* (Hincks). Single hydrotheca (enlarged).
2. Another hydrotheca (enlarged).
3. *Clytia compressa* (Clark). Hydrothecæ (enlarged) showing different degrees of thickening of the hydrothecal walls.
4. Single gonangium (enlarged).
5. *Campanularia ritteri* Nutting. Part of colony (enlarged).

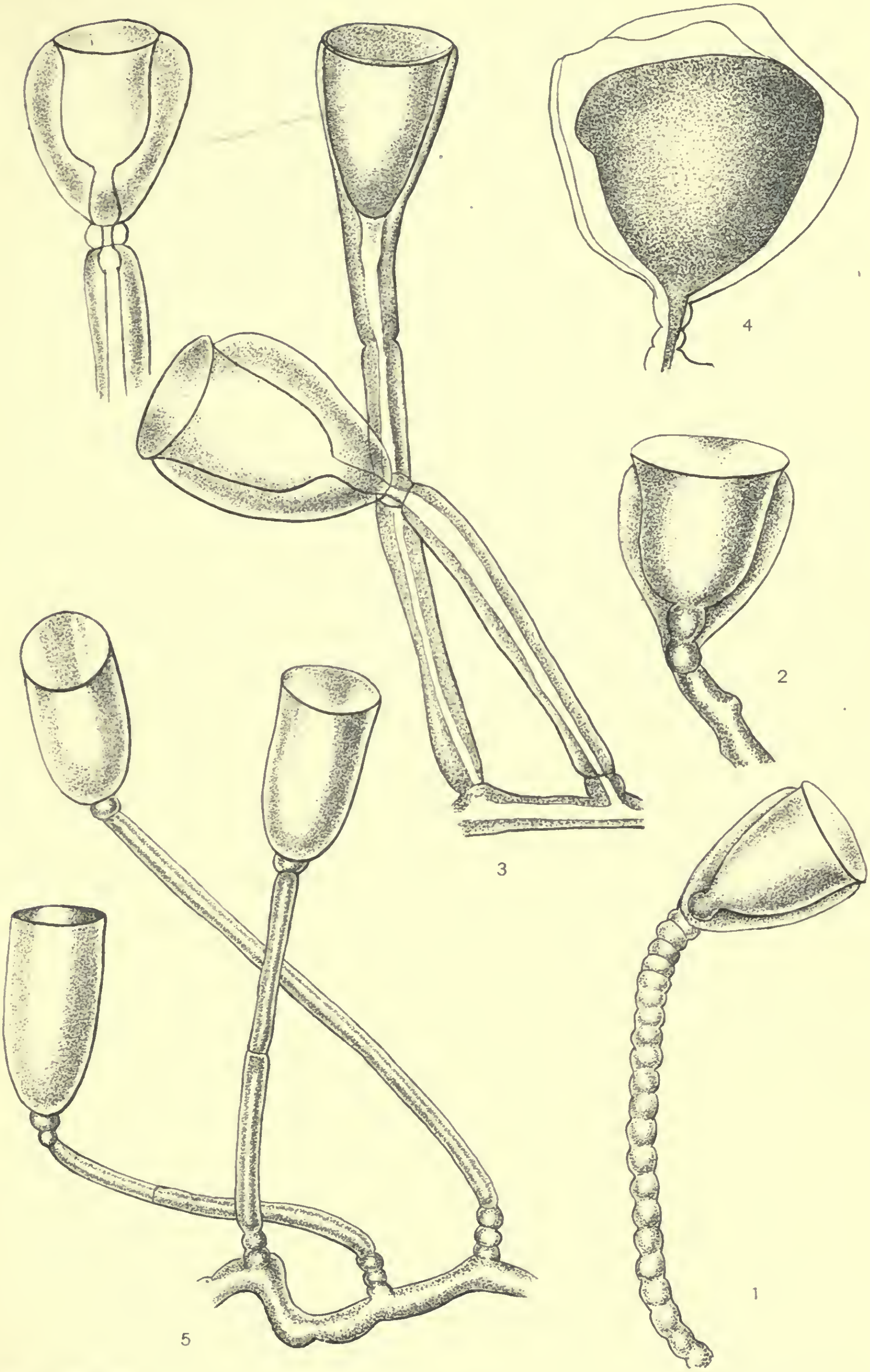

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PLATE VII.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XVIII.]

FIG. 1. *Campanularia reduplicata* Nutting. Part of colony, showing hydrothecæ and gonangium (enlarged).

2. *Campanularia urceolata* Clark. Part of colony, showing hydrothecæ and gonangia (enlarged).

3. *Campanularia speciosa* Clark. Single hydrotheca (enlarged).

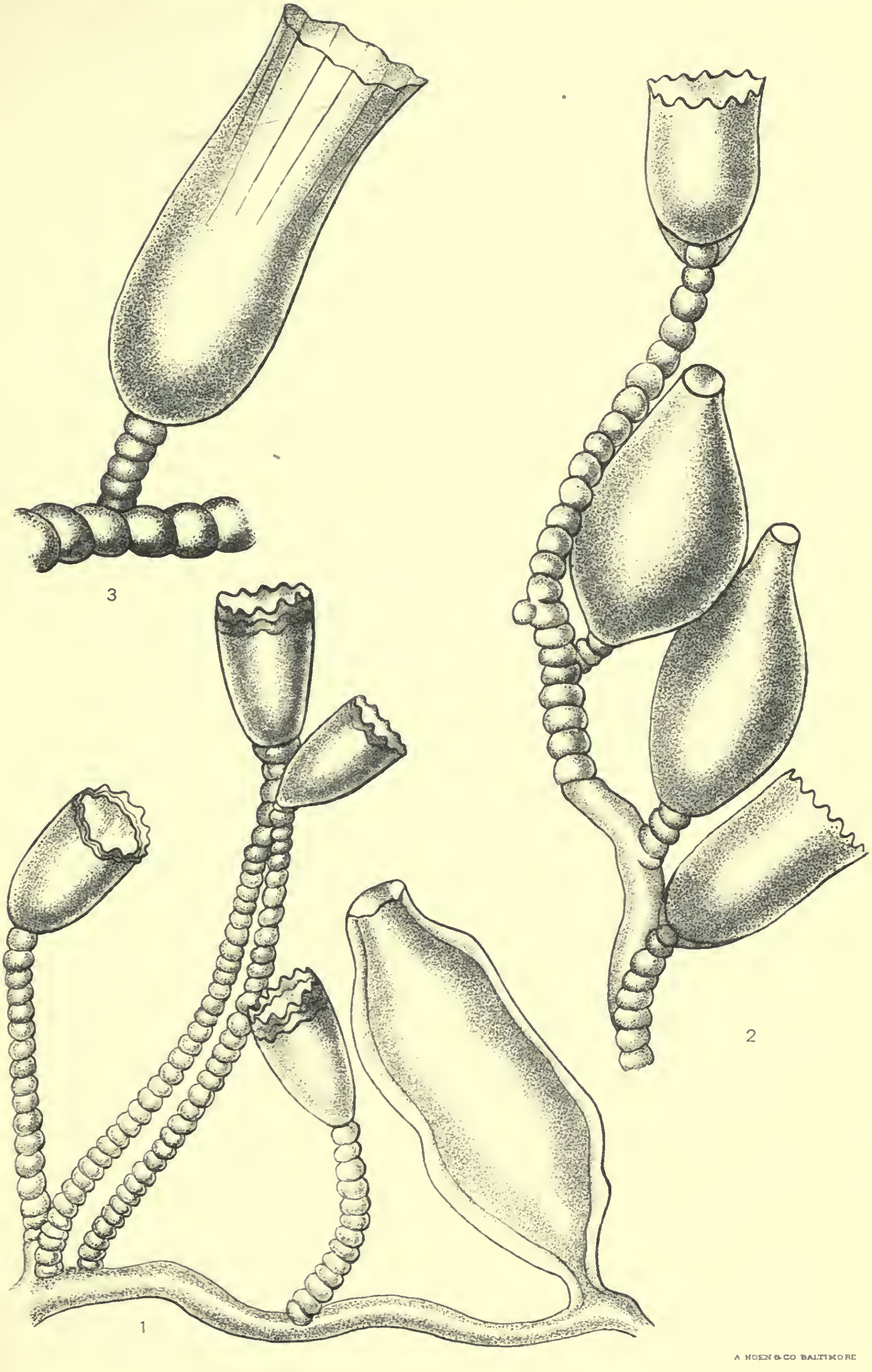

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PLATE VIII.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XIX.]

FIG. 1. *Campanularia regia* Nutting. Single hydrotheca, showing hydranth (much less enlarged than the other figures).

2. Another hydrotheca, showing reduplication of margin.

3. Hydrotheca of *C. speciosa* Clark (drawn to the same scale as fig. 1, to show comparative size).

4. *Obelia borealis* Nutting. Part of colony, showing hydrothecæ and gonangium (enlarged).

5 and 6. Gonangia (greatly enlarged).

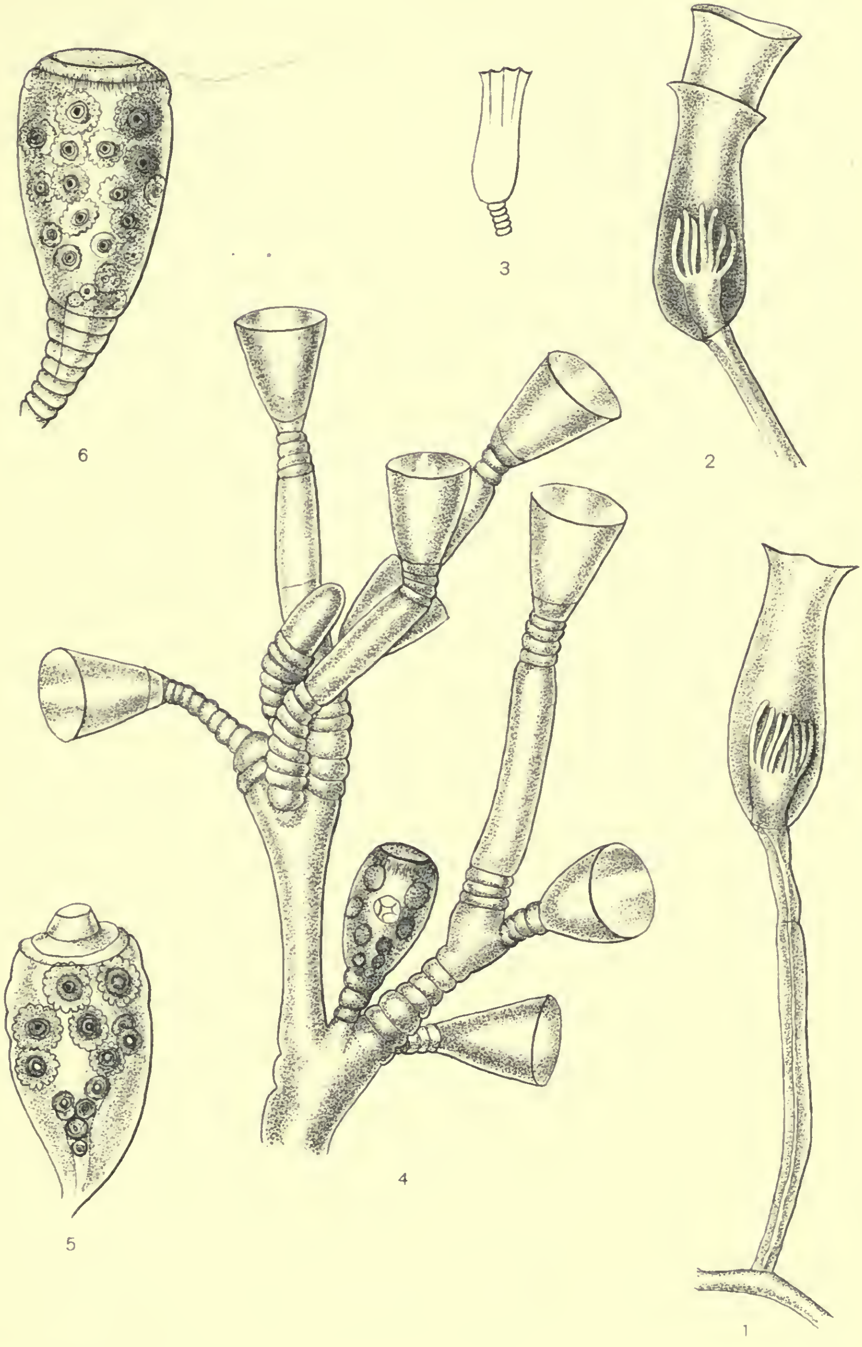

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PLATE IX.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XX.]

FIG. 1. *Obelia dubia* Nutting. Part of colony (enlarged).
2. *Gonothyræa inornata* Nutting. Part of colony, showing hydrothecæ and gonangium (enlarged).
3 and 4. Gonangia (enlarged).

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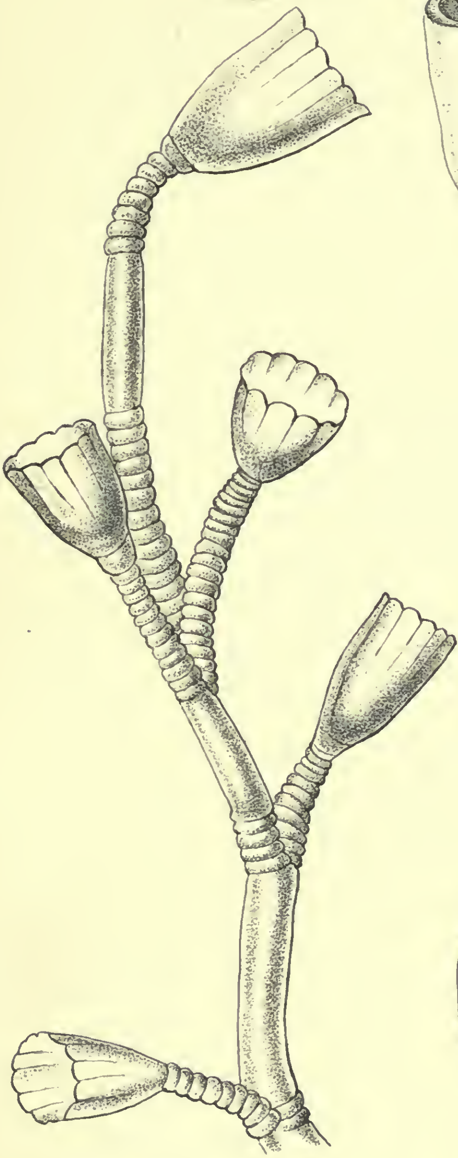

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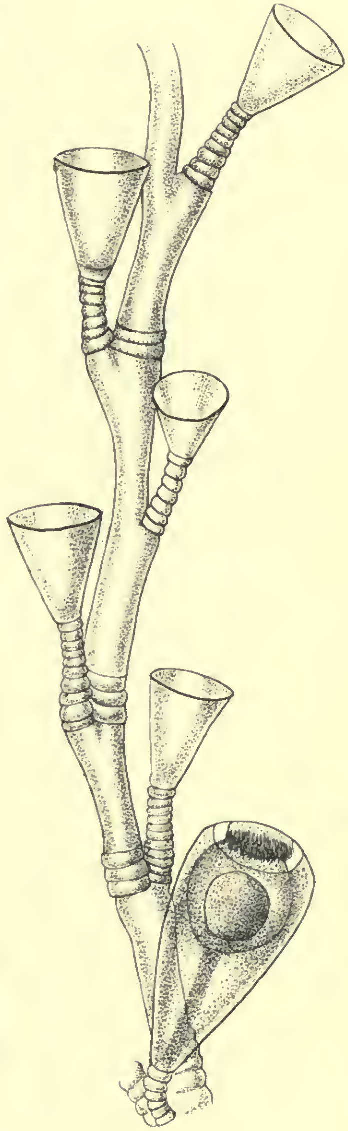

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PLATE X.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XXI.]

FIG. 1. *Campanulina rugosa* Nutting. Part of colony, showing hydrothecæ and gonangia (enlarged).

2. Gonangium, showing developing medusa (enlarged).
3. *Lafœa adhærens* Nutting. Part of trophosome (enlarged).
4. Part of transverse section of gonosome (enlarged).
5. *Grammaria immersa* Nutting. Part of main stem (enlarged).
6. Portion of branch with the peripheral tubes removed to show connection of hydrothecæ with axial tube (more enlarged than fig. 5).

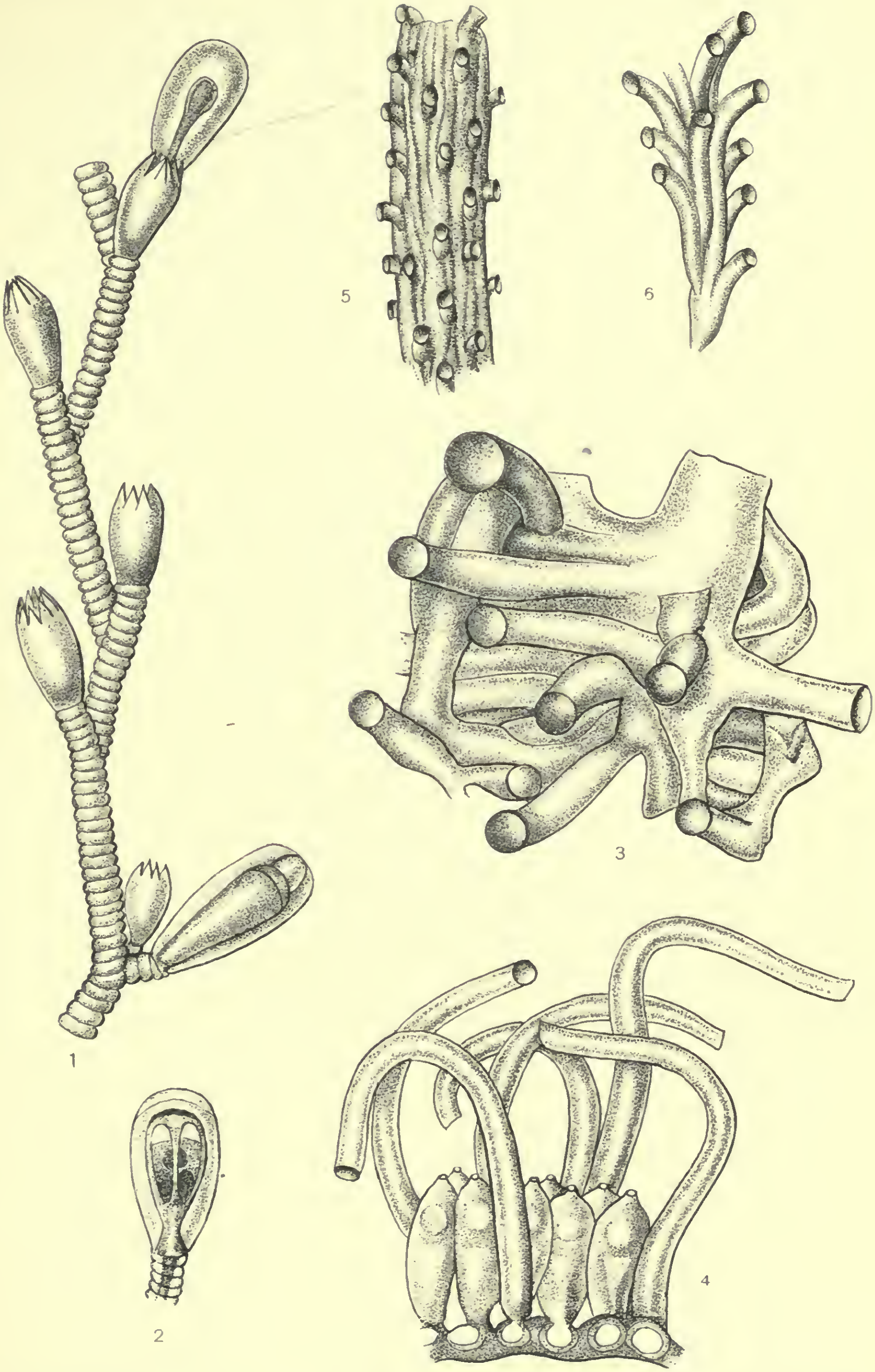

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PLATE XI.

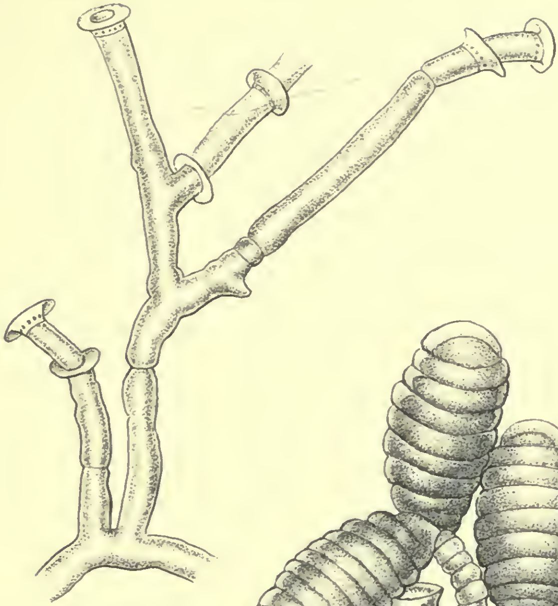
[Proc. Wash. Acad. Sci., Vol. III, Pl. XXII.]

FIG. 1. *Halecium speciosum* Nutting. Part of colony, showing hydrophores and gonangia (enlarged).

2. Single hydranth (greatly enlarged).

3. *Halecium ornatum* Nutting. Part of colony, showing hydrophores (enlarged).

4. Single immature gonangium (enlarged).



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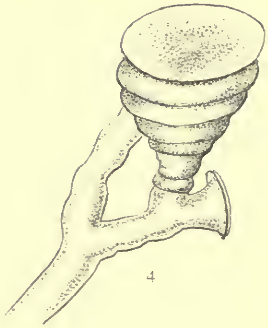

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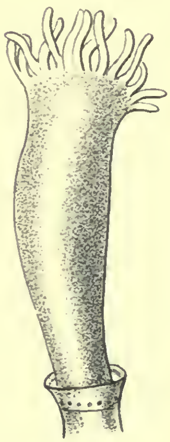

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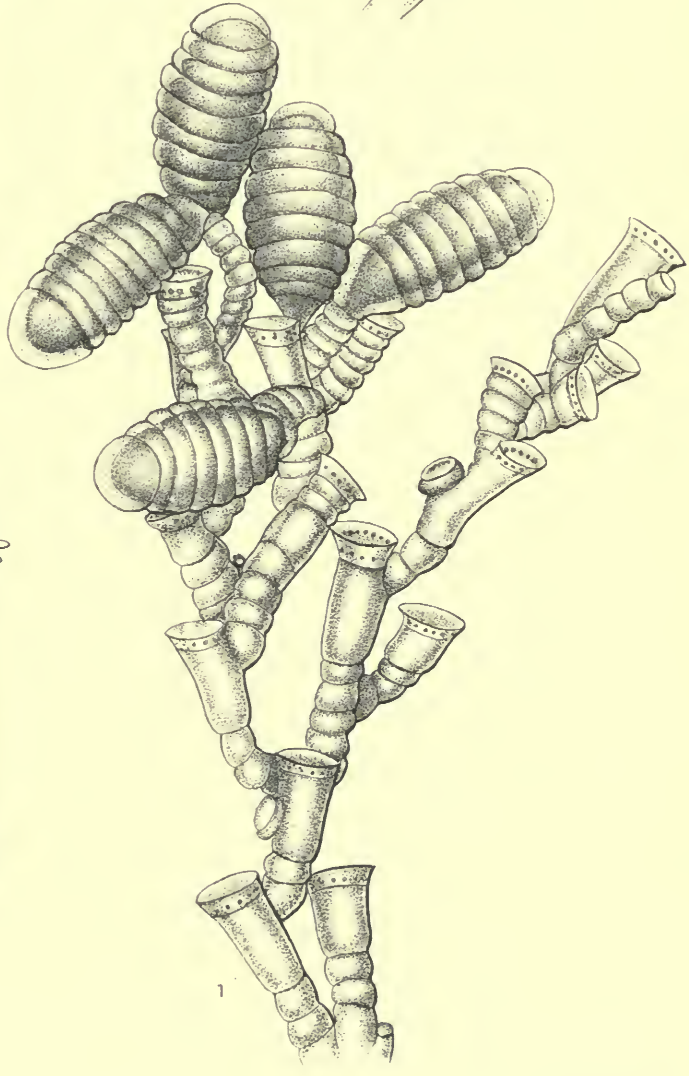

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PLATE XII.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XXIII.]

FIG. 1. *Halecium reversum* Nutting. Part of colony, showing internodes and hydrophores (enlarged).

2. Single hydranth with hydrophore (enlarged).

3. *Halecium robustum* Nutting. Tip of branch, showing expanded hydranths (enlarged).

4. Part of branch with soft parts removed to show the hydrophores (enlarged).

5. Single hydranth with its hydrophore (greatly enlarged).

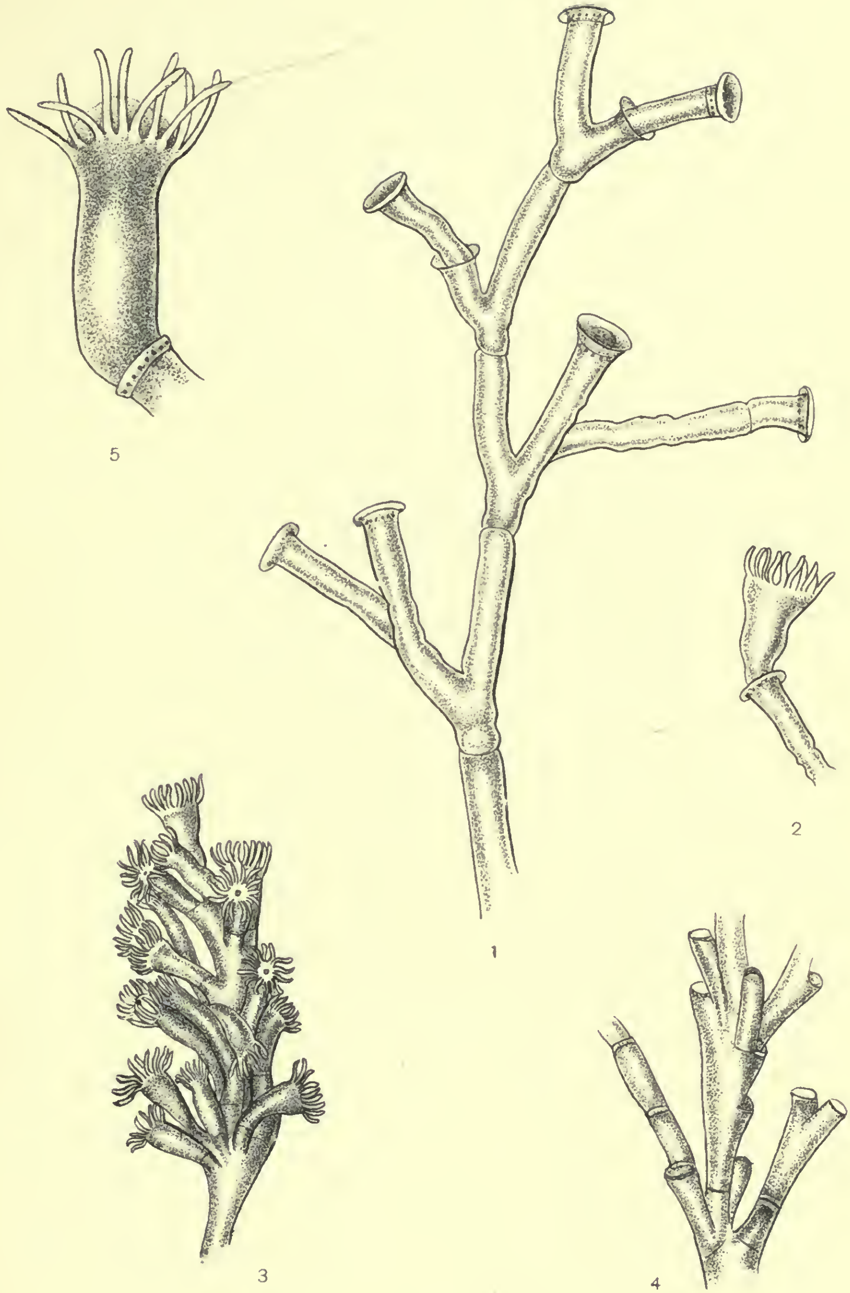

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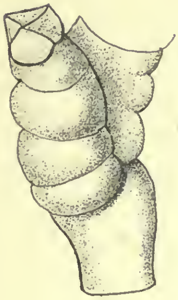
PLATE XIII.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XXIV.]

FIG. 1. *Sertularella saccata* Nutting. Part of colony, showing hydrothecæ and gonangia with acrocysts (enlarged).

2. Three hydrothecæ (still more enlarged).
3. Single hydrotheca, showing operculum (drawn to same scale as fig. 2).
4. *Thuiaria fabricii* (Levinsen). Part of branch showing hydrothecæ and gonangia (enlarged).
5. Front view of part of branch (enlarged).



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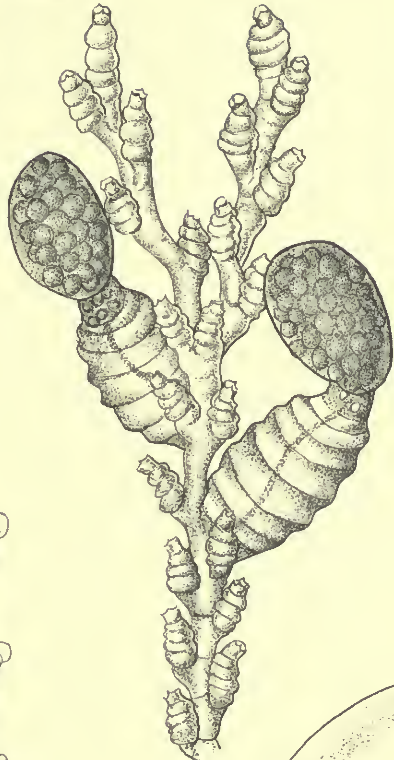

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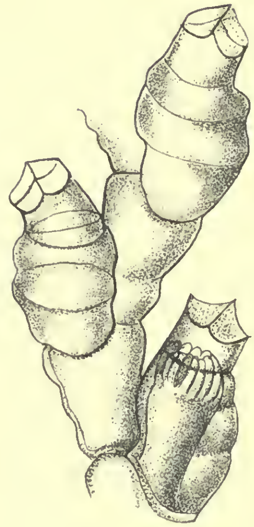

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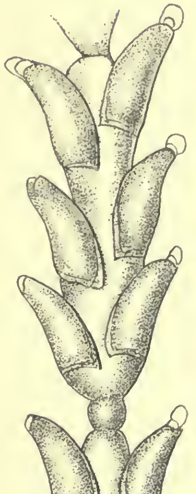

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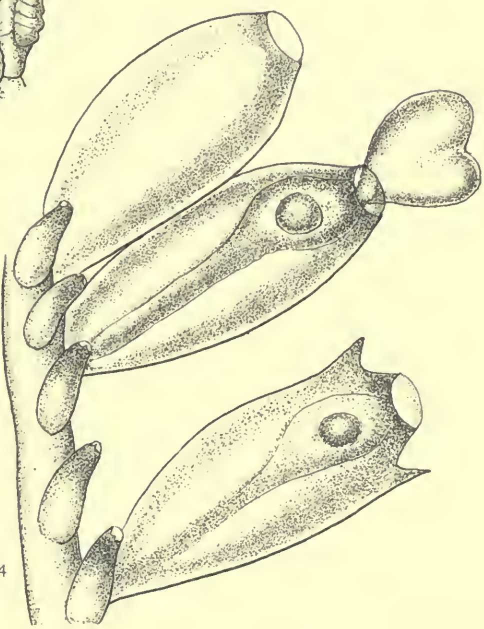

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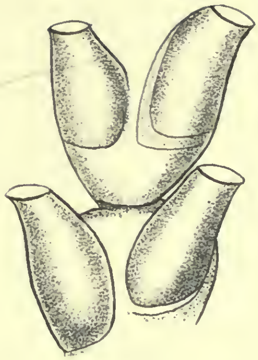
PLATE XIV.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XXV.]

FIG. 1. *Thuiaria elegans* Nutting.
2. Front view of branch (much enlarged).
3. Gonangium (much enlarged).
4. *Thuiaria turgida* Clark.
5. Two pairs of hydrothecæ (much enlarged).
6. Front view of branch (enlarged).

6



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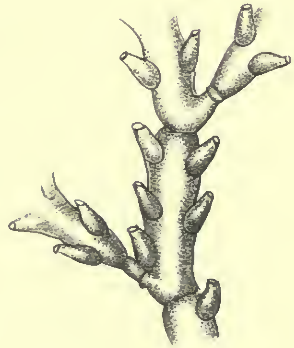

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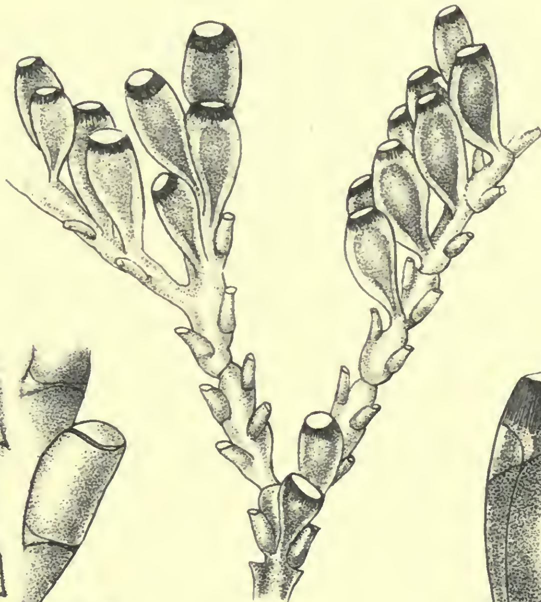

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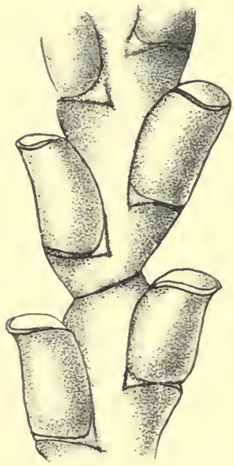

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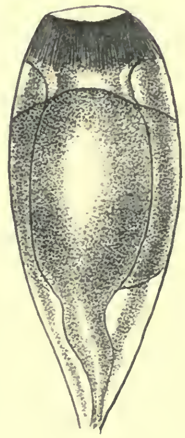

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PLATE XV.

[Proc. Wash. Acad. Sci., Vol. III, Pl. XXVI.]

FIG. 1. *Thuiaria coei* Nutting. Part of branch, showing hydrothecæ and gonangia (enlarged).

2. Lateral view of hydrotheca (enlarged).

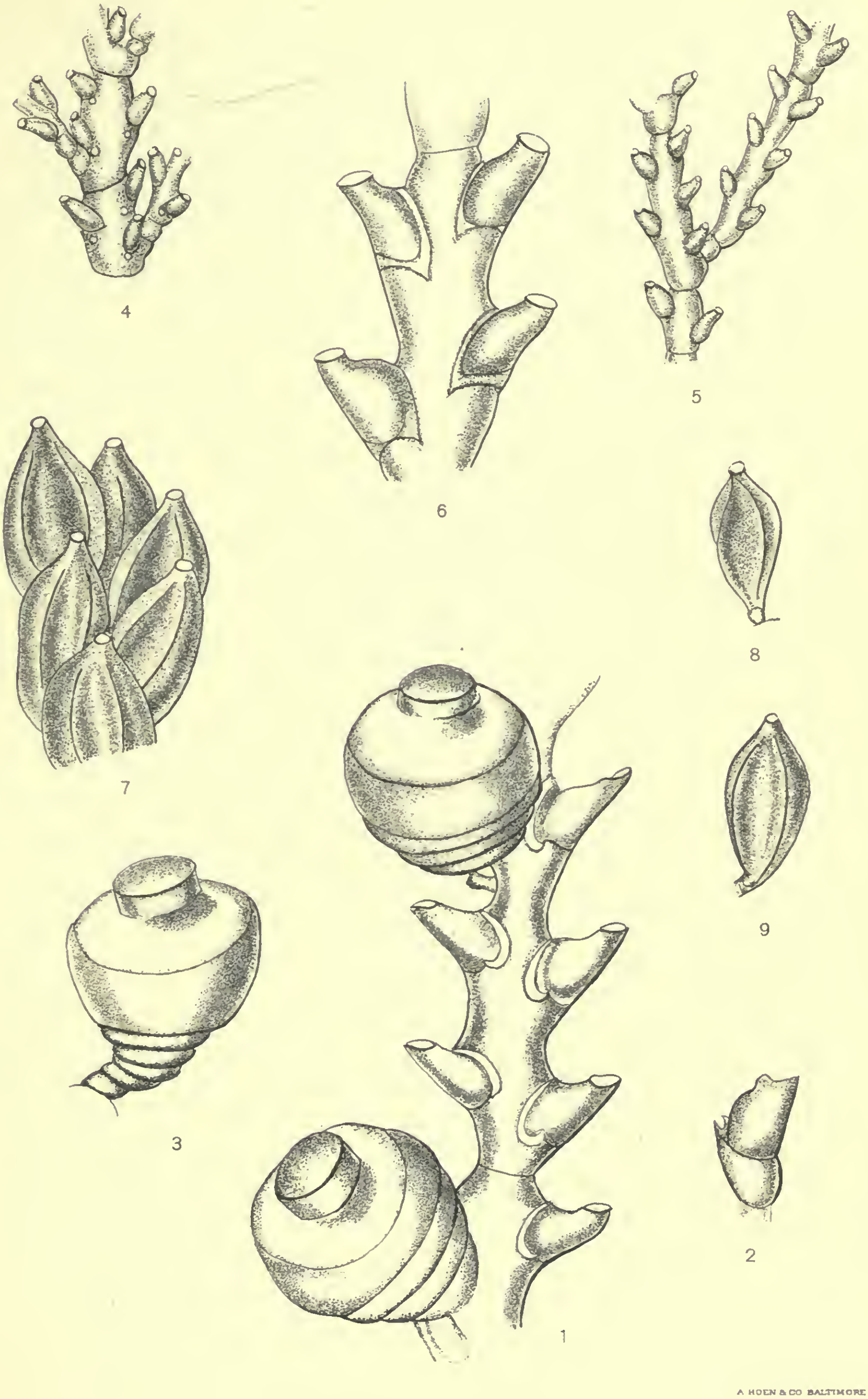
3. Single gonangium (enlarged).

4. *Thuiaria costata* Nutting. Part of main stem, showing origin of branches (enlarged).

5. Front view of terminal branches (enlarged).

6. Two pairs of hydrothecæ (greatly enlarged).

7, 8, 9. Gonangia (enlarged).



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INDEX

New genera and species and the pages on which they are described are in **black-face type**; synonyms in parenthesis; pages where synonymy of known species or genera is given in *italics;* subspecies are treated as species for the purposes of the Index.